COMMERCIAL FERTILIZER

CONSOLIDATED WITH THE FERTILIZER GREEN BOOK

FOR EXTRA BUSHELS

This illustration and headline are from the latest in a series of Barrett advertisements in Southern farm magazines. For small grains, Barrett advertising recommends complete fertilizers at fall seeding followed by nitrogen top-dressing in the late winter or early spring. Thus Barrett advertising helps you to promote a balanced fertilizer program.

We trust that this campaign is helpful in increasing your sales of complete fertilizers and ARCADIAN*, *the American* Nitrate of Soda.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION

NEW YORK 6, N. Y. • RICHMOND 19, VA.
SOUTH POINT, OHIO • HOPEWELL, VA.
ATLANTA 3, GA. • SAN FRANCISCO 3, CAL.

*Reg. U. S. Pat. Off.

THE ELEMENT THAT MAKES PLANTS GROW!

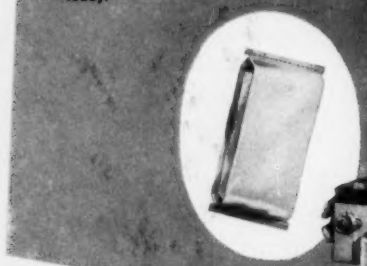
have you investigated the NEW bag closing machine?

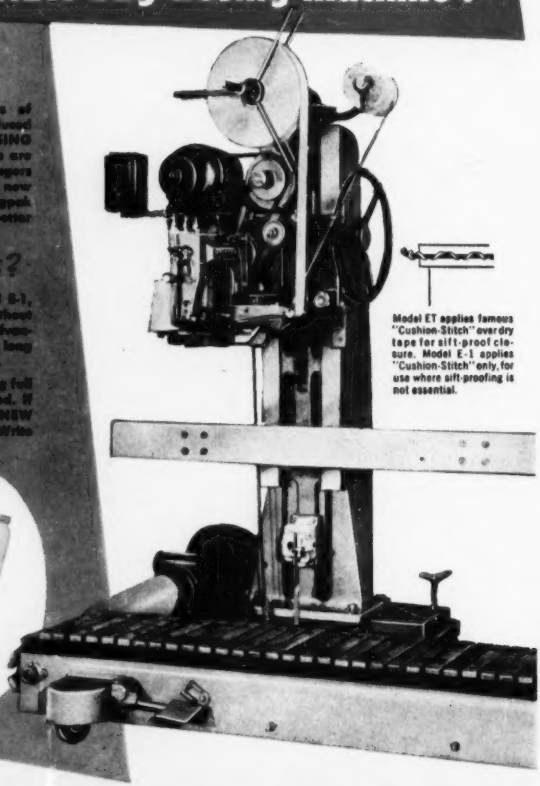
In the year 1950 Bagpak, makers of Bagpak® Multiwall Paper Bags, introduced the NEW MODEL ET BAG CLOSING MACHINE. Many improvements which are important to manufacturers and packagers of a wide variety of materials are now available — improvements like the Bagpak sewn-thru "Dry Tape" closure for better protection at lower cost.

Have you investigated it?

Another Bagpak Machine, the Model E-1, applies the famous "Cushion Stitch" without the "Dry Tape", and offers all the advantages of the other machine — speed, long life, easy and trouble-free operation.

A request on your letterhead will bring full information. No obligation is involved. If you haven't investigated the NEW BAGPAKERS®, be sure to do so now. Write today.





Model ET applies famous "Cushion-Stitch" over dry tape for sift-proof closure. Model E-1 applies "Cushion-Stitch" only, for use where sift-proofing is not essential.

BAGPAK MULTIWALL BAGS

International Paper Company

BAGPAK DIVISION

220 East 42nd St., New York 17

BAG PACKAGING MACHINES

BRANCH OFFICES: Atlanta • Baltimore • Baxter Springs, Kansas • Boston • Chicago • Cleveland • Denver • Los Angeles • New Orleans • Philadelphia • Pittsburgh • St. Louis • San Francisco.

IN CANADA: The Continental Paper Products, Ltd., Montreal, Ottawa.

SMIROW

TANKAGE

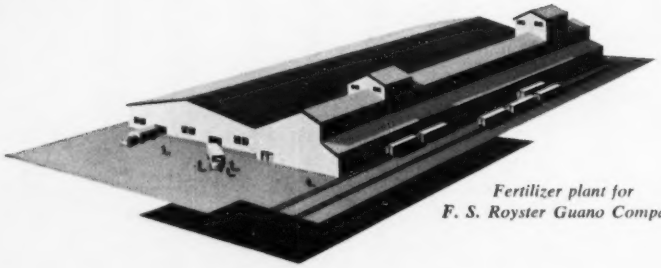
Makes Plants GROW!

Farmers are looking for ways to cut the cost of producing crops. Acreage allotments necessitate larger yields. To meet these requirements, farmers demand quality fertilizers to make plants grow. Correct proportions of SMIROW TANKAGE as a nitrogen source assure QUALITY because SMIROW TANKAGE is 100% natural organic . . . 99% water insoluble and 90% available. It is always in perfect mechanical condition and uniform in texture and color.

To help make your sales grow, write for samples and prices.

SMITH-ROWLAND COMPANY

NORFOLK, VIRGINIA • CHEMICAL, ILLINOIS



Fertilizer plant for
F. S. Royster Guano Company

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Your operations may call for a building of eccentric design or a simple structure—both can be built to suit your requirements with economy by McCloskey. All stresses and loads are carefully calculated to give you a substantial permanent building, tailor-made for you in any width—any length.

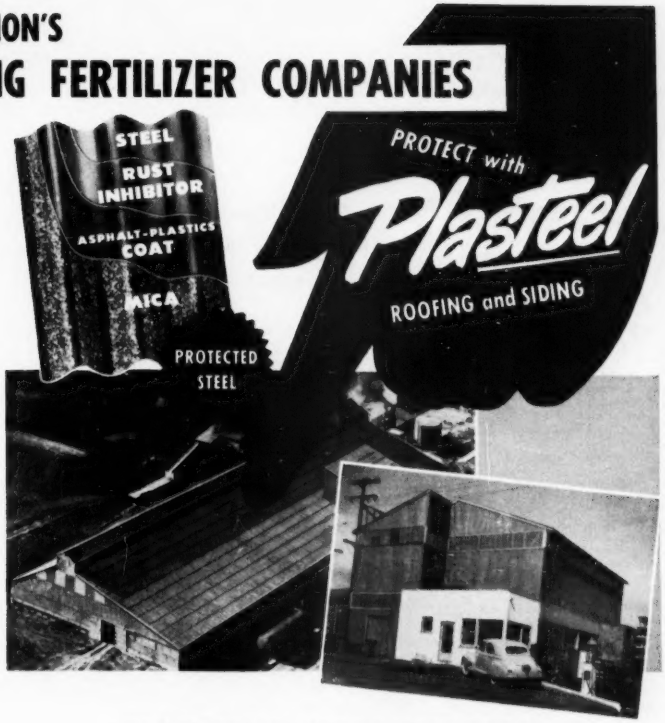
Complete construction service is furnished by McCloskey. Our engineers give you the benefit of their long experience in building industrial plants. They supervise construction from start to finish. Your staff can continue its regular duties without devoting productive time to your building project.

You will be pleased like many of the largest companies around the world with your McCloskey Buildings. They have found that the complete construction services save them time and money. The modern flexible design also saves on initial investment and future maintenance.

Call on McCloskey before you plan your new building or plant. Learn how you can get the best buildings and at the same time save money. Write McCloskey Company of Pittsburgh, 3412 Liberty Avenue, Pittsburgh 1, Pa.

McCloskey Company
of Pittsburgh

THE NATION'S
LEADING FERTILIZER COMPANIES



PLASTEEL IS CORROSION-PROOF

resists acid fumes, smoke, gases, alkalies, heat, cold, moisture, etc.

PLASTEEL is just what the Fertilizer Industry needs . . . a protected steel roofing and siding that is immune to all atmospheric and plant conditions. As illustrated above, PLASTEEL is triple protected steel—**triple-protected on both sides of the steel sheet.** That is why PLASTEEL is air-tight, weather-sealed and corrosion proof. Truly a building material that is permanent and maintenance-free! Needs no paint, no repairs. And that's not all . . . PLASTEEL is attractive in appearance, easy to handle, speedy to erect and economical!

Let Plasteel solve your corrosion and maintenance problems. Send rough sketches or complete prints of your needs. We'll submit estimates and suggestions. There is no obligation for our Engineering Service.

MAIL TODAY FOR COMPLETE DETAILS

PLASTEEL PRODUCTS CO.
Washington, Pennsylvania

☐ Send New Plasteel Handbook
☐ Samples of Plasteel Roofing

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

(Pin Coupon to your Letterhead)

PLASTEEL
PRODUCTS CO.
WASHINGTON, PA.
Offices in principal cities

COMMERCIAL FERTILIZER

ESTABLISHED 1910

January, 1951

Vol. 82, No. 1

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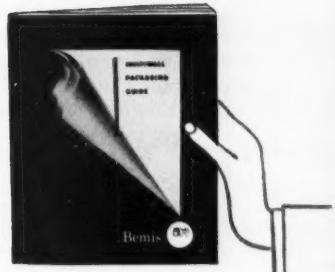

GET YOUR COPY OF

Bemis Multiwall Packaging Guide

. . . it shows how to do a more efficient packaging and handling job and save materials and labor. Deals with Storage of Empty Bags, Filling and Closing, Handling of Filled Bags, Palletizing and other important topics. Ask your Bemis Man or write to the nearest Bemis office. No cost to you, of course.

Bemis

BEMIS BRO. BAG COMPANY

PEORIA, ILL. · EAST PEPPERELL, MASS. · MOBILE, ALA. · SAN FRANCISCO, CALIF. · VANCOUVER, WASH.
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AA QUALITY® Fertilizers
18% NORMAL© Superphosphate
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AGRINITE®—the organic Plant Food
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CALCIUM ARSENATE
BORDEAUX MIXTURE
DEROX 0.75% Rotenone
NICOTINE PYROX®—garden spray
PYROX®—with Arsenical—no nicotine
POTATO POWDER No. 1
PHOSPHODUST®—Diluent for dusts

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PHOSPHORIC ACID
DISODIUM PHOSPHATE
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PHOS-FEED®—Calcium Phosphate Mineral Mixture

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ELEMENTAL PHOSPHORUS—Yellow White
PHOSPHORUS RED (Amorphous)
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FERRO PHOSPHORUS (Iron Phosphide)
SLAG

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BONE OIL
PRECIPITATED BONE PHOSPHATE

KEYSTONE® AMMONIUM CARBONATE U.S.P.

SALT CAKE

SULPHURIC ACID

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Baughman

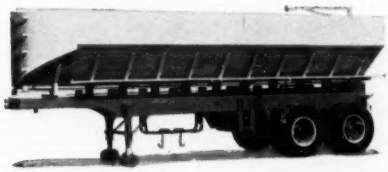
MODEL O-2 ATTACHMENT

spreads rock phosphate faster and more economically than any other method

Specially designed to prevent material from packing and crusting—perfect for spreading rock phosphate, dry powdered lime and other fertilizing materials.

Spreads from 100 to 5000 pounds per acre . . . covers 2 acres for every mile traveled at speeds up to 15 mph. Gives uniform spreads on the level, slopes or hillsides. Spreads 16½ feet widths.

The Model O-2 is 16½' wide . . . folds for highway travel.



"HI-SPEED" LOW COST TRANSPORT

For efficient bulk hauling of superphosphate. Positive belt drive conveyor in bottom of body unloads quickly and with minimum agitation. Compartmentized. Waterproof roof can be installed. Standard sizes—no high cost of special construction.

BAUGHMAN also builds bodies for hauling rock phosphate, limestone and other commercial fertilizers. A model for your every need.

MODEL 235 HOLDS SPREADS TO THE GROUND

For Model K, K-2 and K-3 Bodies . . . prevents wind from scattering spreads. Confines air blast from distributor . . . directs materials outward and groundward. Causes the spread to LAY and STICK. Spreads limestone up to 30 feet . . . phosphate and other fertilizers up to 20 feet. Opens to 18 feet quickly and easily . . . folds for highway travel.

MODEL Q PORTABLE CONVEYOR

Loads and unloads from the horizontal to 60°. Capacity up to 40 bu. per minute. Big 9" conveyor screw handles any dry, powdered or granular materials. Available with or without wheels — hundreds of applications.

WRITE . . . for complete details of BAUGHMAN fertilizer handling and spreading equipment.

Usually Delivered from Stock

BAUGHMAN MANUFACTURING CO., Inc.
311 SHIPMAN ROAD JERSEYVILLE, ILLINOIS

"The Pioneers of the Fertilizer Spreading Industry"

JUST AROUND THE CORNER

By Vernon Mount

Confidence in Charles E. Wilson will change the public mind. The hopeless, helpless feeling will be replaced as that aggressive, capable, sincere executive takes hold of the biggest job he or anyone else ever tackled.

"Deputy President" comes mighty close to summing up his function, because - subject only to HST - he can take over control of any existing war-preparation function, create new ones.

He hates bureaucrats and red tape and boondoggling. His knife will slash clean as his broad powers permit. And if he can help it, war plants will not be filled with featherbedding as they were in the last war.

Confidence in Eisenhower will help restore faith in US among West Europe's nations, and faith in themselves. At best they are broken reeds to lean on. At best, the way things stand now, we could only delay a Russian move Westward. But if anyone can handle the politico-military-diplomatic problems, Ike can.

Plan for years of mounting armament, and you won't be caught short. I don't say war will come. But our economy will be on a war basis for at least five years, with all it means in shortages of materials and manpower; with controls going deeper and deeper into your private life and business; with hundreds of billions to be paid back some day in taxes.

A grim way to start a New Year, but we might as well face facts.

Yours faithfully,

Vernon Mount

JANUARY
OR
JULY
RAYMOND
MULTI-WALL
PAPER SHIPPING SACKS
. . . are on the job in the Fertilizer industry
Every day in the year—winter or summer—wherever fertilizers are packed or shipped, you'll find Raymond Multi-Wall Paper Shipping Sacks on the job. They are the preferred Shipping Sacks among producers, packers, and shippers who specify the best quality container for their product.
They're
DUST-PROOF! SIFT-PROOF!
WATER-RESISTANT!
Custom Built
PRINTED OR PLAIN
VARIOUS SIZES, TYPES,
STRENGTHS
R

This year give your fertilizers the advantage of the top Shipping Sack in the industry. You'll like the way Raymond Multi-Wall Paper Shipping Sacks protect your product, their sales appeal. A Raymond representative will be glad to assist you in selecting the Raymond Shipping Sack ideally suited to your packing requirements.

THE RAYMOND BAG COMPANY, Middletown, O.

POTASH
TRONA
SALTS

Trona
Muriate of Potash

This vitally important ingredient of mixed fertilizer provides the soil nutrient necessary to resist plant diseases and to enhance the productivity of crops. To obtain the best results, specify "Trona" Muriate of Potash . . . made by the pioneer producers in America.

Three Elephant
Agricultural Pentahydrate
Borax

Contains a minimum of 44% B_2O_3 or approximately 121% equivalent Borax. More economical in this concentrated form when used as an addition to fertilizer or for direct application to the soil, to correct a deficiency of Boron. Consult your local County Agent or State Experimental Station.

AMERICAN POTASH & CHEMICAL CORPORATION

122 EAST 42nd STREET • • • NEW YORK 17, N. Y.

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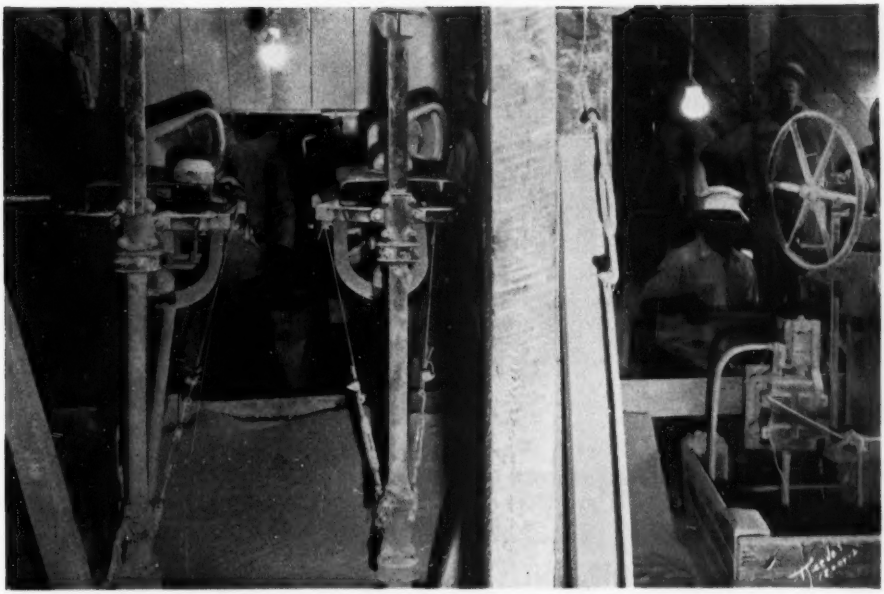
LOS ANGELES 54, CALIF.



EXACT WEIGHT Sacking Scales in operation at the Southern Fertilizer Company plant, Atlanta, Georgia

Sound Fertilizer Packaging From One Compact Weighing Unit...

A sound volume fertilizer packaging operation should require only normal labor expense . . . should eliminate any double handling . . . rule out extra trimming and checkweighing . . . in fact cut handling costs everywhere possible. In EXACT WEIGHT Sacking Scales all of these factors have been incorporated in a single compact weighing unit for accuracy with speed of operation. With improved no-waste valves and newly designed bag holders these scales are better than ever. The fill, weigh and check method with but one man per scale is still the best combination for getting out the bags at the lowest cost. It's the easiest, cheapest and most profitable way . . . it's the EXACT WEIGHT Way . . . Write for full details covering the new models.

SALES and SERVICE in all Principal Cities from Coast to Coast and Canada.

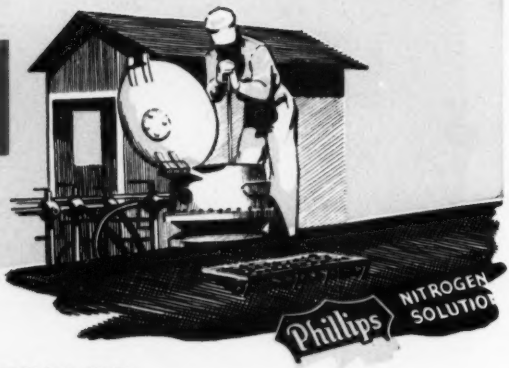
EXACT WEIGHT SCALES

Industrial Precision

THE EXACT WEIGHT SCALE COMPANY

906 W. Fifth Avenue • Columbus 8, Ohio
2920 Bloor St, W Toronto 18 Canada

PHILLIPS 66 NITROGEN SOLUTIONS



FOR MORE N PER DOLLAR

HERE'S concentrated nitrogen—at low cost! Yes, Phillips 66 Nitrogen Solutions give you more N per dollar, with less inert material than conventional solid sources of fertilizer nitrogen. Phillips 66 Nitrogen Solutions are particularly well suited to the preparation of high-analysis fertilizers and the ammoniation of superphosphate.

Investigate now the many economies offered to you by Phillips 66 Nitrogen Solutions. They keep your handling costs low and promote rapid curing. Phillips 66 Nitrogen Solutions are shipped by tank car from our Etter, Texas plant. Write our nearest district office for full information.

PHILLIPS 66 NITROGEN SOLUTIONS

	No. 1 %	No. 2 %	No. 3 %
TOTAL NITROGEN	40.6	40.8	37.0
NITRATE NITROGEN	11.36	9.62	11.65
AMMONIA NITROGEN	29.24	31.18	25.35
WATER	13.3	18.5	16.6
AMMONIUM NITRATE	65.0	55.5	66.8
ANHYDROUS AMMONIA	21.7	26.0	16.6

PHILLIPS CHEMICAL COMPANY

A Subsidiary of Phillips Petroleum Company

FERTILIZER SALES DIVISION • BARTLESVILLE, OKLA.

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OMAHA, WOW Building · LOS ANGELES, 4521 Produce Plaza West · AMARILLO, First National Bank Bldg.

AMMONIUM SULFATE · AMMONIUM NITRATE · NITROGEN SOLUTIONS · ANHYDROUS AMMONIA

There's Plus Value in

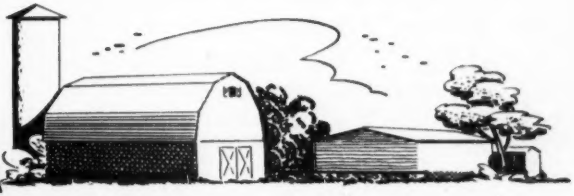
COTTON BAGS

Farmers don't overlook the fact that in buying a ton of fertilizer in 100 lb. COTTON BAGS, they get more than 20 yards of good cotton cloth to be used in money-saving ways in the home.

Millions of farm women sew . . . make attractive clothing and home furnishings . . . with cotton bags.

Additional advantages of Cotton Bags, which are of value to YOU as well as your farmer customers, are that Cotton Bags are easier to handle, haul and store . . . are less subject to waste from snags or tears.

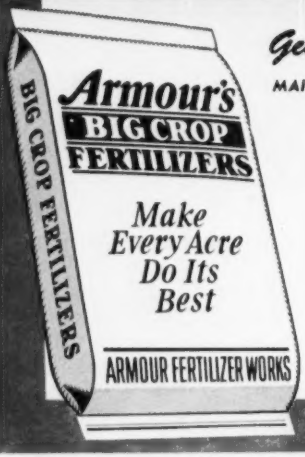
As a headliner for your fertilizer sales promotion, Cotton Bags of Fulton Quality Sheeting, Osnaburg and Toweling will be star performers for you. Your nearest Fulton branch will be glad to work with you. Call on us.



Fulton BAG & COTTON MILLS

Atlanta • New Orleans • Dallas • St. Louis • Kansas City, Kans.
Minneapolis • Denver • Los Angeles • New York City

ARMOUR FERTILIZER WORKS



General office: HURT BUILDING
ATLANTA, GA.

MAILING ADDRESS: P. O. BOX 1685, ATLANTA 1, GA.

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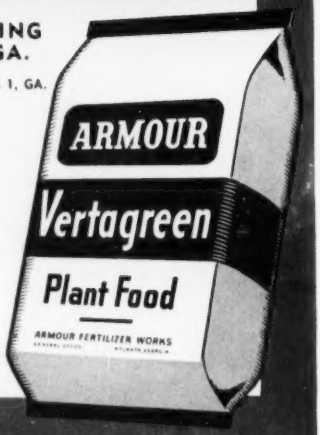
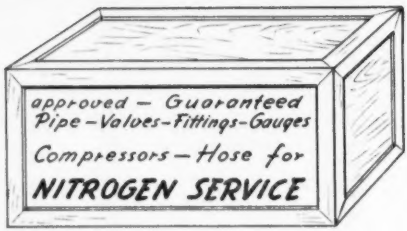


Approved Piping Equipment for NITROGEN SOLUTIONS

Handling Nitrogen Solution, even under pressure, is an easy job for pipe, valves, fittings and other accessories that are designed for this corrosive job. Aluminum piping with "quick opening" valves designed to carry Nitrogen Solution, insure a trouble-free piping system that will carry this solution from the tank-car to your storage tank, and then to your mixer. Air hose, pipe and an adequate compressor to give the pressure you need for quick, efficient operation must be free from any copper or copper alloy connections, brazing, or welding.



A piping layout using these materials, is approved by all the major producers of this chemical. These materials are available from one source. Ask your Solution Representative, and write for free bulletin showing a detailed piping layout and complete "bill of materials".

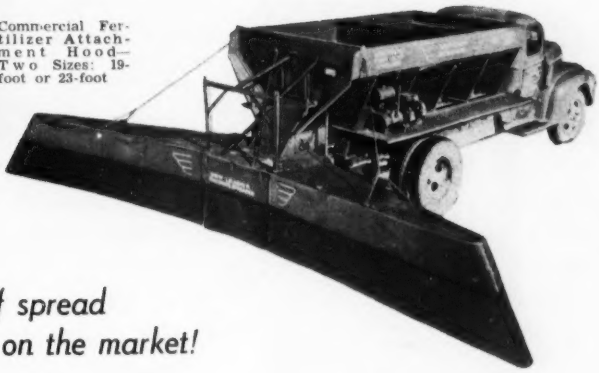
J. M. TULL METAL & SUPPLY CO., Inc.

285 Marietta Street N.W.

Atlanta 3, Georgia

Here's the answer to your Spreading Problems!

AGAIN! "The NEW LEADER" leads the field



Commercial Fertilizer Attachment Hood—Two Sizes: 19-foot or 23-foot

with its new "Motor-Driven Spreader" offering greater accuracy of spread with the most positive feed on the market!

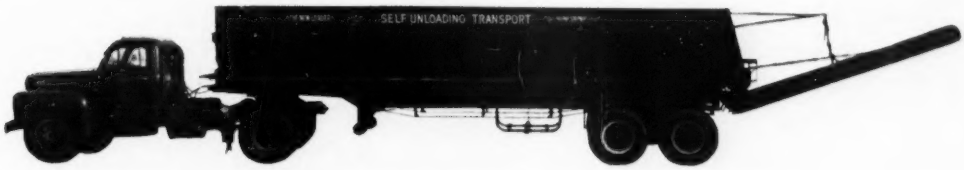
SPECIAL ADVANTAGES— Uniformity of spread is not dependent on truck speed. Motor is mounted on catwalk and drives only the twin distributor discs at a constant speed, assuring full width of spread at all times together with uniform distribution.

Conveyor is separately driven from truck drive shaft by a series of V-belts to deliver the correct amount per acre—regardless of truck speed or regardless of whether the truck is driven in low, super-low or any other gear.

Conveyor speed is, therefore, positively synchronized with speed of the rear wheels of truck and at each revolution of the rear wheels, the conveyor moves a given distance regardless of the truck's speed. Amount of material delivered by conveyor does not vary with hilly or soft field conditions.

Spreader Body Lengths (inside measure) are 9', 11', 13' and 15'. Other body lengths on special order.

Note: When Spreading Attachment is folded up for road-traveling position, width is approximately 7'-5"



"The NEW LEADER" Self-Unloading Bulk Transport

The 20-ton capacity transport above is shown with elevator in place and ready to load a NEW LEADER Spreader truck. These units are proving very profitable; in bad weather they eliminate demurrage on railroad cars; fertilizer gets to the job quickly and spreader trucks can be kept working in the field. The transport, being a self-unloading unit, leaves the tractor truck free to return to pick up another transport load. These units have four individual compartments of 5 tons each. Each compartment may be unloaded independently of the others. Compartments and rear endgate are removable so that bagged and packaged goods may be hauled instead of bulk loads. Capacity 5 tons to 25 tons, lengths from 11 ft. to 40 ft. Written warranty with all NEW LEADER equipment. Write today for specifications, prices, etc. Fast delivery service sells fertilizer!

HIGHWAY EQUIPMENT COMPANY, INC. CEDAR RAPIDS, IOWA

MANUFACTURERS OF THE WORLD'S MOST COMPLETE LINE OF SPREADERS

PROMPT
DELIVERIES
INTERNATIONAL
PHOSPHATES

Florida Pebble Phosphate

ALL COMMERCIAL GRADES

Tennessee Phosphate

PHOSPHATE DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

General Offices: 20 North Wacker Drive, Chicago 6
Mines and Plants in Florida at Noralyn, Peace Valley, Achan, Mulberry, in Tennessee at Mt. Pleasant and Wales.

USDA Report on Fertilizer Equipment

The increasing use of various forms of fertilizers in this country has caused fertilizer equipment to become the most diversified of any type of farm machinery now on the market, says Glenn A. Cumings, agricultural engineer of the U. S. Department of Agriculture. Speaking before the winter meeting of the American Society of Agricultural Engineers in Chicago December 20, Cumings outlined progress in the development of fertilizer machinery and cited industry's opportunity for greater improvement in years to come.

Today's fertilizer equipment ranges from small, hand-operated devices through tractor units and self-unloading trucks to aircraft with spreading attachments. This equipment is used to apply fertilizers as gases, liquids, crystals, granules and finely divided particles. Furthermore, Cumings pointed out, present day fertilizer machinery is often incorporated with an implement designed to do several other farm jobs.

Cumings outlined one new trend in which fertilizer equipment is being designed as the basic unit and interchangeable planters, drills, seeders, and cultivators are used as attachments.

An example of the versatility of modern fertilization machinery described by the Department engineer is the commercially produced two-hopper fertilizer unit that mounts on the front of a rear-engine tractor. The fertilizer from each hopper can be delivered through either one or two tubes. Fertilizer can be applied as side dressing for

(Continued on page 44)

It Seems to Me

by BRUCE MORAN

The spectacle of the people of the United States bowing down to "American Productive Power"—which is merely a wartime phrase for "Free Enterprise"—is amusing, or would be if the situation were not so very serious. Because these obeisances occur only when the Nation is in peril, and Free Enterprise is the only hope of salvation. The rest of the time, business is an octopus, whose tentacles . . . etc. etc. ad nauseam.

I suppose we should not let this disturb us. The American people do the same thing to ball players, who are heroes only while their batting average is high.

But it seems to me, and has for a long time, that there should be some way by which Americans could be taught that business is of consequence in the payment of shoes for Baby, and the bill at the grocers.

That is something we should take up after the war, because just now business is too busy preparing to defend the last real bulwark of Free Enterprise, and thus the freedom of a lot of Americans.

. . . and a Happy New Year

The Commercial Fertilizer staff takes this means to thank all the good friends who sent us holiday greetings. We only wish we could stop and write each of you, but there were so many! Please accept our personal wishes for a very Happy New Year.

Highlights of

Following our annual policy of asking the associations in this industry to review their activities for our readers, we present here the report from the American Plant Food Council prepared by their own staff. In November NFA reported. Shortly we will present reports from the regional associatoins.

Fertilizer industry historians will record two significant chapters in the life of the American Plant Food Council during the year 1950—one of the outstanding services of the late Clifton A. Woodrum, first president of the Council and the other on the successful tour of selected industry operations he planned for 16 of the Nation's best known farm magazine editors.

Mr. Woodrum worked effectively and conspicuously for 28 years of his life as a champion of the Nation's private enterprise system—23 years as a member of Congress from his native state of Virginia and for five years as president of the Council.

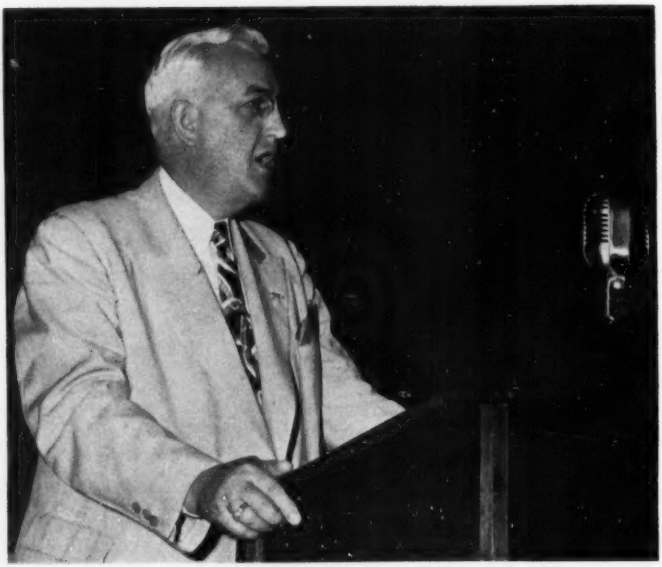
He believed, with all sincerity, that the fertilizer industry had what he termed "a good story to sell" and thanks largely to his efforts there is today—in the words of his Board of Directors— " . . . a better understanding of the fertilizer industry, its contribution to agriculture and its relation to the National economy as a whole."

Four days prior to his death suddenly on October 6, Mr. Woodrum had completed his plans to accompany some of the country's most outstanding farm magazine editors on an eight-day, 4,000 air-mile tour of phases of the fertilizer industry to better acquaint them, and indirectly their 33,000,000 farm family readers, with the wealth of scientific "know how" the tremendous investments and the efficiency of management necessary in the production of plant foods from the raw materials to the finished product ready for use on the farm.

The success of the tour of nitrogen, phosphate, potash and mixed fertilizer operations, marred only by the absence of the Council's president, now has passed into history as one of the most beneficial and educational projects ever sponsored by any trade association group—and that's the consensus of the editors themselves.

The Council's tour via chartered plane for farm magazine editors easily was the most outstanding educational project during the 1950 operations of the organization. One, insofar as officials of the Council are able to determine, the tour for the first time furnished an opportunity for editors to obtain an over-all appraisal of some of the important industry segments of

CLIFTON A. WOODRUM



The fertilizer industry and the Nation as a whole lost an outstanding leader and champion of the private enterprise system in the death of Clifton A. Woodrum, first president of the American Plant Food Council, who died suddenly October 6, 1950. Of him his Board of Directors said:

"He rendered notable and effective service in creating a better understanding of the fertilizer industry, its contribution to agriculture and its relation to the National economy as a whole."

APFC Activities

great importance to the agricultural production of the Nation. Two, the tour was the first of its kind in the history of aviation.

Ferdie Deering, newly-elected president of the American Agricultural Editors' Association and editor of THE FARMER-STOCKMAN, Oklahoma City, summarized the appraisal of the writers when he termed the tour a " . . . highly educational short course."

Ray Yarnell, editor of CAPPER'S FARMER, Topeka, upon his return from the tour, told his 4,000,000 farm family readers editorially that:

"The fertilizer industry, which plays such an important part in profitable farming, is an example of the free enterprise system functioning at its best."

Mr. Yarnell referred to the industry as " . . . the kind of operation that has made this Nation great and that we must preserve, no matter what the cost."

Other magazines represented on the tour by top-flight editors were:

C. L. Mast, Jr., Editor, AGRICULTURAL LEADERS' DIGEST, Chicago; Arnold Nicholson, Managing Editor, COUNTRY GENTLEMAN, Philadelphia; Ralph D. Wennblom, Associate Editor, FARM JOURNAL, Philadelphia; Dr. L. R. Neel, Editor, FARM & RANCH—SOUTHERN AGRICULTURIST, Nashville; William H. Kircher, Associate Editor, THE FARMER, St. Paul; Eugene Meyer, Associate Editor, HOARD'S DAIRYMAN, Fort Atkinson (Wis.); Milon Grinnell, Editor, THE MICHIGAN FARMER, East Lansing; Earl McMunn, Associate Editor, OHIO FARMER, Cleveland; M. C. Gilpin, Managing Editor, THE PENNSYLVANIA FARMER, Harrisburg; Jim Thomson, Managing Editor, PRAIRIE FARMER, Chicago; W. C. Lassetter, Vice President and Editor, THE PROGRESSIVE FARMER, Memphis; Dr. Paul D. Sanders, Editor, THE SOUTHERN PLANTER, Richmond; Jim Roe, Managing Editor, SUCCESSFUL FARMING, Des Moines and Merrill Gregory, Managing Editor, WALLACES' FARMER & IOWA HOMESTEAD, Des Moines.

IN MEMORIAM RESOLUTION ADOPTED BY THE BOARD OF DIRECTORS OF THE AMERICAN PLANT FOOD COUNCIL, INC.
DECEMBER 6, 1950
IN HONOR OF THE LATE
CLIFTON A. WOODRUM

WHEREAS, the Honorable Clifton A. Woodrum served with distinction and honor as the first president of the American Plant Food Council, Incorporated until his death October 6, 1950, and

WHEREAS, he established himself in the respect and affection of his State and Nation for his courageous and effective championship of the principles upon which our private enterprise system is founded, and

WHEREAS, he rendered notable and effective service in creating a better understanding of the fertilizer industry, its contribution to agriculture and its relation to the National economy as a whole, and

WHEREAS, as an acknowledged leader in Congress for 23 years he was constructive, practical and farsighted in his approach to National affairs, always consistent with common sense in encouraging private initiative and discouraging regimentation, and

WHEREAS, by his character and devotion to duty, his courage of conviction, his integrity of purpose and his love of mankind, he established himself in the esteem of all who knew him and was singularly effective as a spokesman for business without being unmindful of the well-being of his fellow citizens, and

WHEREAS, his untimely death removes from Government and business a leader of influence for a better, stronger Nation, a friend with practical understanding of human weaknesses and appreciation for human fortitude,

THEREFORE BE IT RESOLVED, that the Board of Directors, in session this sixth day of December, Nineteen Hundred and Fifty, unanimously record their respect, appreciation and admiration for the late Clifton A. Woodrum, and recognize his effective leadership in the affairs of state and in the field of industry and particularly his manifold contributions in strengthening American business as the best safeguard of American democratic institutions, American initiative and American strength,

BE IT FURTHER RESOLVED, that a copy of this resolution be sent to the family of the deceased, that a copy be incorporated in the minutes of this meeting, that a copy be incorporated in the 1951 Journal of Proceedings of the American Plant Food Council and that a copy be sent to each of the fertilizer trade magazines.

APFC AIMS

The American Plant Food Council has become well established in the field of service to the industry and agriculture in general—and members of the Council look to the future with confidence in terms of accomplishments under the aims and purposes of the organization which are to:

1. Support and encourage the agricultural research, educational and control agencies.

2. Inform its membership, farmers and others concerning the plant food needs as viewed by recognized agricultural research agencies.

3. Promote the operation of the fertilizer industry under the present system of private enterprise in continuing to solve the plant food problems of agriculture in cooperation with established research and educational institutions.

4. Cooperate with farmers and their organizations in developing policies designed to place agriculture on a self-supporting basis.

5. Foster the lawful interests of the plant food industry.

6. Encourage the conservation of our basic plant food resources.

LEADERSHIP

Council achievements during the past year and during the past five years have been shared by farsighted Boards of Directors and progressive Executive Committees.

Chairmen of the Council's Executive Committees, in the order that they have served, include such outstanding industry leaders as:

Ralph B. Douglass, President, Smith-Douglass Co., Inc., Norfolk, Va.; C. B. Robertson, President, Robertson Chemical Corp., Norfolk; Fred J. Woods, President, The Gulf Fertilizer Co., Tampa, Fla.; J. A. Howell, President, Virginia-Carolina Chemical Corp., Richmond, Va. and W. T. Wright, Vice President, F. S. Royster Guano Co., Norfolk, present chairman.

Other members of the 1950-51 Executive Committee are:

John V. Collis, President, Federal Chemical Co., Louisville, Ky.; J. A. Howell, President, Virginia-Carolina Chemical Corp., Richmond, Va.; A. F. Reed, Vice President, Lion Oil Co., El Dorado, Ark.; and Paul Speer, Vice President, U. S. Potash Co., New York City.

The Council's Board of Directors follows:

American Plant Food Council conventions, under the leadership of the late Clifton A. Woodrum as President, have attracted large audiences to hear some of the Nation's most distinguished leaders in the field of farm organizations, research, education and Government. More than 500 members of the industry and others attended the 1950 convention. Shown above are members and guests listening to W. R. Thompson, Associate Leader, Extension Agronomy, Mississippi State College, declare that "few people realize that the United States needs a minimum of 108,500,000 tons of mixed fertilizer such as 6-8-8 on just pastures."

DIRECTORS

Term Expiring June 30, 1951: James F. Doetsch, President, Chilean Nitrate Sales Corp., New York City; Ralph B. Douglass, President, Smith-Douglass Co., Inc., Norfolk, Va.; A. F. Reed, Vice President, Lion Oil Co., El Dorado, Ark.; J. D. Robbins, Vice President, Planters Cotton Oil & Fertilizer Co., Rocky Mount, N. C.; Paul Speer, Vice President, U. S. Potash Co., New York City; W. T. Steele, Jr., Cooperative Fertilizer Service, Inc., Richmond, Va.; A. Douglas Strobhar, President, Southern Fertilizer & Chemical Co., Savannah, Ga. and W. T. Wright, Vice President, F. S. Royster Guano Company, Norfolk, Va.

Term Expiring June 30, 1952: Luis R. Gonzalez, President, Ochoa Fertilizer Corp., Hato Rey, P. R.; J. A. Howell, President, Virginia-Carolina Chemical Corp., Richmond, Va.; W.

Hampton Logan, President, Logan-Robinson Fertilizer Co., Charleston, S. C.; George E. Petitt, Vice President, Potash Company of America, New York City; Ashmead F. Pringle, Jr., President, A. F. Pringle & Co., Charleston, S. C.; Walter S. Rupp, The Baugh & Sons Co., Baltimore, Md.; John E. Sanford, President, Armour Fertilizer Works, Atlanta, Ga. and Frank S. Washburn, American Cyanamid Co., New York City.

Term Expiring June 30, 1953: W. B. Badenoch, Vice President, Richmond Guano Company, Richmond, Va.; John V. Collis, President, Federal Chemical Co., Louisville, Ky.; George Cushman, Gen. Mgr., Long Island Produce & Fertilizer Co., Inc., Riverhead, N. Y.; Howard Fisher, Gen. Mgr., The Michigan Fertilizer Co., Lansing, Mich.; George W. Gage, President, Anderson Fertilizer Co., Inc., Anderson, S. C.; C. B. Robertson, President, Robertson Chemical Corp., Norfolk, Va.; Fred J. Woods, President, The Gulf Fertilizer Co., Tampa, Fla. and M. S. Wright, President, Texas Farm Products Co., Nacogdoches, Texas.

MEMBERSHIP

Council members represent a cross-section of the fertilizer industry some of whose operations are located from coast to coast. Membership is open to any person, partnership, firm, association, cooperative or corporation engaged in producing, mining, refining, importing, manufacturing or selling phosphate rock, superphosphate, potash salts, nitrogen compounds and other carriers of recognized palnt food or engaged in the mixing of these materials for use as plant food.

ACTIVITIES

The Council's operations, aims and purposes and achievements have been particularly significant in terms of creating a better understanding by all groups of the industry and its operations in relationship to sound farming practices.

Council Active in Educational, Research Programs

A Nation-wide essay contest on the subject of "Soil Fertility and the Nation's Future" was conducted by the Council in 1950 in cooperation with the National Grange, America's oldest farm organization. The contest attracted entries from more than 20,000 young men and women through 20 years of age representing all 48 states and the District of Columbia.

Nationally-known leaders in the field of agriculture and education were judges for the contest which is regarded as one of the Council's outstanding projects designed to ". . . stimulate not only interest but practical application of methods in safeguarding our soil's fertility which is directly related to the future of our Nation."

The contest judges were:

The Honorable Knox T. Hutchinson, Assistant Secretary of Agriculture, Chairman; Dr. Hugh H. Bennett, Chief, Soil Conservation Service, USDA; Miss Lois M. Clark, Assistant Director, Division of Rural Service, National Education Association; Dr. W. T. Spanton, Chief, Agricultural Education Service, U. S. Office of Education and Dr. M. L. Wilson, Director of Extension Work, USDA.

Albert S. Goss, Master of the National Grange until his death in October, said that "translated into sound conservation and benefits to future crops, the result of this ("Soil Fertility and the Nation's Future" contest) actually is beyond calculation." He added that in planning the contest, the Grange found the American Plant Food Council ". . . an organization which was equally interested in the conservation of the soil."

In conducting the contest, the Council received notable cooperation from national and state organizations and agricultural leaders concerned with our soil and how to keep it productive. A similar contest in 1949 with the Grange as a co-sponsor attracted an additional 20,000 essay entries.

In furtherance of the Council's aims and purposes, the Council has entered into many other programs designed to further strengthen important agricultural educational and research operations.

Numerous research fellowships have been established by the Council in many states to add further to the scientific knowledge on the importance of plant foods in our economy of abundance and particularly in strengthening sound land management programs.

Council Furnishes Fertilizer Information

Like many useful trade associations, the Council's informational program is routine but highly important in providing an accurate picture of the fertilizer industry operations and services. Since the Council was founded, one of the major contributions to industry and agricultural generally has been the dissemination of factual information particularly to members of Congress, farm organization leaders, agricultural education groups as well as many others concerned with fertilizers and their relationship to a sound farming economy.

The normal service rendered by the Council to its members and others include: the dissemination of factual information through NEWS LETTERS, memorandums, official Government reports and newspaper and magazine material dealing particularly with such matters of concern to the industry.

The Nation's farm magazines, trade publications, such as COMMERCIAL FERTILIZER, Government publications, newspapers and radio stations receive periodic stories on industry as well as Council activities. In addition, special photographic coverage of industry operations and events in which the Council participates are furnished editors of publications.

Many conferences annually are held by the staff with nationally-known authors and publication representatives whom the Council assist in the preparation of articles and other material for publication on the subject of fertilizer and fertilizer usage.

Our Land and Its Care in Great Demand

One of the most successful agricultural education projects sponsored by the Council was the publication of "Our Land and Its Care." The publication grew out of a well-known demand by agricultural leaders and others for a simplified text on the subjects of land management, soil conservation and plant food usage.

The demand for "Our Land and Its Care" has been so great

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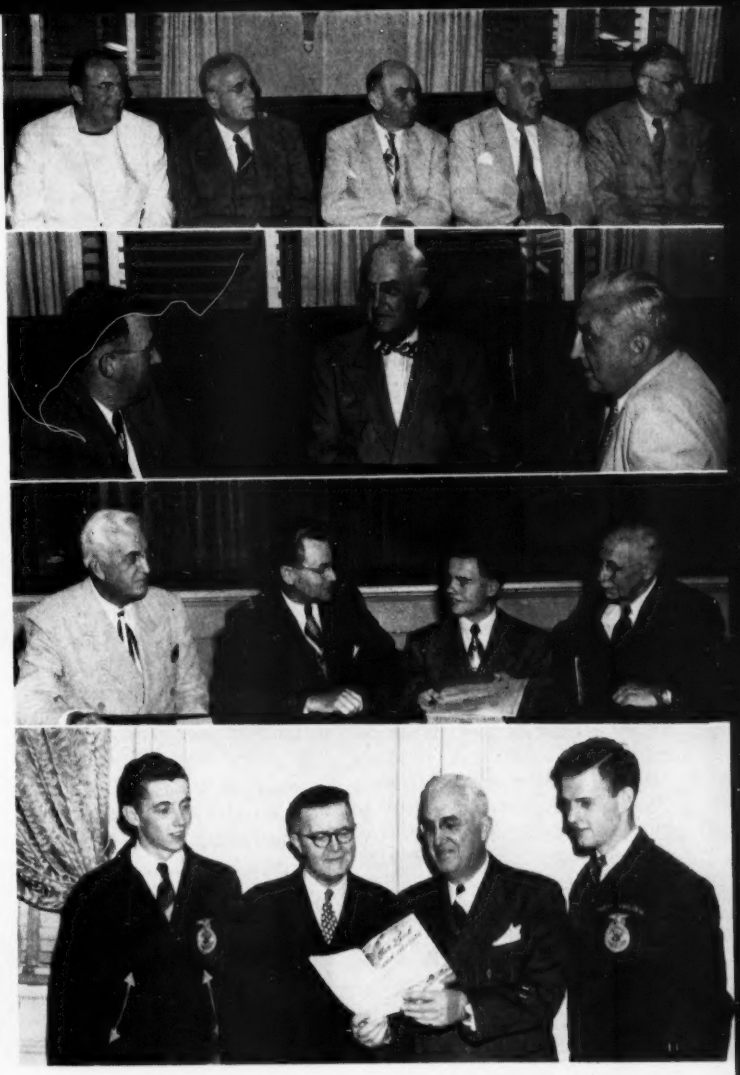
1. When the American Plant Food Council brought to a close its eight-day tour of selected fertilizer industry operations covering 4,000 air miles, the 16 editors of nationally known farm magazines who were their guests termed the trip "truly a fertilizer short course."

As a result of the tour, the 33,000,000 farm family readers of the 16 farm publications will have a better knowledge of the magnitude, scientific know-how, tremendous investments and efficient operations of the plant food industry which has a great deal in common with farm publications in terms of the well being of agriculture.

Ferdie Deering, (third from left) newly-elected President of the American Agricultural Editors Association and Editor of THE FARMER-STOCKMAN, Oklahoma City, summarized the Council's tour of selected industry operations as a "highly educational short course," and Ray Yarnell, (left) Editor of CAPPER'S FARMER, Topeka, on his return from the tour wrote editorially that "the fertilizer industry . . . is an example of the free enterprise system functioning at its best." Others shown in the picture left to right are: M. C. Gilpin, Editor, THE PENNSYLVANIA FARMER, Harrisburg and Earl McMunn, Editor, OHIO FARMER, Cleveland.

2. The editors visited nitrogen plants, phosphate mining and refining operations, potash mines and refineries and climaxed the tour with a visit to a modern mixed fertilizer plant. Shown above (front row) left to right, are: C. L. Mast, Jr., Editor, AGRICULTURAL LEADERS' DIGEST, Chicago, Ill.; Ray Yarnell, Editor, CAPPER'S FARMER, Topeka, Kans.; Arnold Nicholson, Managing Editor, COUNTRY GENTLEMAN, Philadelphia, Pa.; Ralph D. Wennblom, Associate Editor, FARM JOURNAL, Philadelphia, Pa.; William H. Kircher, Associate Editor, THE FARMER, St. Paul 2, Minn.; Ferdie Deering, Editor, THE FARMER - STOCKMAN, Oklahoma City, Okla.; Eugene Meyer, Associate Editor, HOARD'S DAIRYMAN, Fort Atkinson, Wis.; Milon Grinnell, Editor, THE MICHIGAN FARMER, East Lansing, Mich.; Earl McMunn, Editor, OHIO FARMER, Cleveland, Ohio; (back row) left to right: M. C. Gilpin, Editor, THE PENNSYLVANIA FARMER, Philadelphia, Pa.; Jim Thomson, Managing Editor, PRAIRIE FARMER, Chicago, Ill.; W. C. Lassetter, Vice President and Editor, THE PROGRESSIVE FARMER, Memphis, Tenn.; Dr. L. R. Neel, Editor, FARM & RANCH — SOUTHERN AGRICULTURIST; Dr. Paul D. Sanders, Editor, THE SOUTHERN PLANTER, Richmond, Va.; Capt. Dutt and Co-pilot Malone of Capital Airlines; Jim Roe, Managing Editor, SUCCESSFUL FARMING, Des Moines, Iowa; Merrill Gregory, Managing Editor, WALLACES' FARMER & IOWA HOMESTEAD, Des Moines, Iowa; Dr. John R. Taylor, Jr., and Louis H. Wilson of American Plant Food Council; third row, Miss Jean Crocco, Hostess and O. E. Willmann, Representative, both of Capital Airlines.



1. Outstanding leaders in the fertilizer industry are serving on the American Plant Food Council's 1950 Executive Committee and shown above, left to right, are: J. A. Howell, President, Virginia-Carolina Chemical Corp., Richmond, Va.; John V. Collis, President, Federal Chemical Co., Louisville, Ky.; A. F. Reed, Vice President, Lion Oil Co., El Dorado, Ark.; W. T. Wright, Vice President, F. S. Royster Guano Co., Norfolk, Va., Chairman and Paul Speer, Vice President, U. S. Potash Co., New York City.

2. Cooperation with farmers and their organizations has been prominent in the Council's programs. Shown above left to right, are: Rex Carter, (left) Uniontown, Penna., 1950 President of the National Association of County Agricultural Agents who is conferring with W. T. Wright, (extreme right) Vice President, F. S. Royster Guano Company, Norfolk, Va. and chairman of the Council's Executive Committee and the late Clifton A. Woodrum, President of the Council.

3. One of the outstanding education projects conducted by the Council in 1950 was a Nation-wide essay contest jointly sponsored by the National Grange. More than 20,000 young men and women through 20 years of age, representing all 48 states, entered essays and the winner was George F. Dunbar, (third from left) of East Craftsbury, Vermont, who received $1,000 first prize. Shown with Dunbar are left to right: the late Clifton A. Woodrum, president of the Council; Assistant Secretary of Agriculture Knox T. Hutchison, Chairman of the Board of Judges and the late Albert S. Goss, Master of the National Grange.

4. Unusually heavy demands for the American Plant Food Council's publication "Our Land and Its Care" have necessitated another revision which will bring the total circulation to more than three-quarters of a million copies. A simplified text on the complicated subjects of land management, soil conservation and plant food usage, the publication has been widely acclaimed by leaders and workers in the field of agriculture.

Prepared in collaboration with the Agricultural Education Service of the U. S. Office of Education, the picture shows the late Clifton A. Woodrum, (second from right) when he was serving as president of the American Plant Food Council handing Dr. W. T. Spanton, chief of the Agricultural Education Service of the U. S. Office of Education the first copy of "Our Land and Its Care" in 1947 and looking on are: William G. Carlin (extreme left) of R. D. 4, Coatsville, Pa. 1947 "Star Farmer of America" and Gus R. Douglass, Jr., of Grimms Landing, W. Va., (extreme right) 1947 National President of the Future Farmers of America. Both Carlin and Douglass joined Dr. Spanton in warmly praising the publication as a contribution to "the future of farming."

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that the Council again will "go to press" with a revised edition bringing the total number of copies to more than three-quarters of a million.

"Our Land and Its Care" was prepared by the Council in collaboration with the Agricultural Education Service of the U. S. Office of Education, the Chief of which, Dr. W. T. Spanton, described the publication as "... a simplified presentation of land management and soil conservation."

Distribution has been particularly great among farmers, vocational teachers, county agents, soil scientists and farm organizations.

PLANT FOOD JOURNAL

Serving Agriculture

The PLANT FOOD JOURNAL, quarterly magazine of the American Plant Food Council, has attracted increased appreciation among soil scientists and agricultural workers as a medium for accurate and timely information on soil and land management problems as viewed by some of the Nation's most distinguished scientists and others who have achieved National reputations as authors on agricultural subjects.

The demand for the JOURNAL since it was established

three years ago has resulted in doubling the circulation which already included all of the Nation's county agents, U. S. Department of Agriculture officials, Directors of Extension Service and Experiment Stations, Agronomists, Members of Congress, the entire fertilizer industry and many other organizations and leaders concerned with the importance of maintaining, replenishing and increasing the fertility of our soils.

Typical of the service provided by the PLANT FOOD JOURNAL was an issue in 1950 devoted exclusively to grassland farming with authors and their subjects including:

"Grassland Farming" by C. B. Bender, Research Specialist in Dairy Husbandry, N. H. Agricultural Experiment Station, New Brunswick; "The Virginia Pasture Program" by H. L. Dunton, Head, Agronomy Department and P. H. DeHart, Extension Agronomist, Virginia Polytechnic Institute, Blacksburg; "Grass Holds Our Future" by D. R. Dodd, Extension Agronomist, Ohio State University, Columbus and "Irrigated Pastures in California" by M. L. Peterson, Asst. Professor of Agronomy, University of California, Davis.

Visual Aids Service

Visual aids are playing an increasingly important role in the field of agricultural education.

Shortly after the Council was formed, a motion picture committee consisting of James F. Doetsch, President, Chilean Nitrate Sales Corp., New York City, Chairman; George W. Gage, President, Anderson Fertilizer Co., Inc., Anderson, S. C. and W. T. Wright, Vice President, F. S. Royster Guano Co., Norfolk, Va., was appointed and "First in the Hearts of Farmers" became the Council's first 16mm. motion picture.

"First in the Hearts of Farmers," a professionally produced film, has been shown already to more than a million and half persons predominately in the field of farming. Wide acclaim of the film and its general usefulness are attested by the fact that although issued three years ago, the demands for showings today keep nearly 200 prints in constant circulation.

The Council's motion picture committee since its formation has been active in seeking worthwhile scripts and stories which could be translated into motion pictures having a place of great utility in the field of agricultural education.

National Leaders on Council Programs

Like most organizations, the annual conventions of the American Plant Food Council have attracted distinguished leaders in the field of agricultural education, research and Government.

Such notables as United States Senator-elect Everett M. Dirksen (then Congressman from Illinois); United States Senator Clinton P. Anderson (then Secretary of Agriculture); Washington and Lee President Francis P. Gaines; Representative Harold D. Cooley (Chairman of the House Agriculture Committee) and Dr. Douglas Southall Freeman, eminent historian and author have been principal speakers at the annual banquet sessions of the Council.

Many of the country's best known soil scientists, farm magazine editors and other leaders in the field of agriculture have appeared on the organization's convention programs.

FORM ANHYDROUS AMMONIA ASSN.

Anhydrous ammonia manufacturers, distributors and applicators from more than a score of states perfected the organization of the National Agricultural Ammonia Association in Memphis, Tenn., early in December with the adoption of a constitution and by-laws and the election of officers.

E. H. Gill, Flint Steel Co., Memphis, was elected president; Virgil Rule, Greenville Liquid Fertilizer Co., Greenville, Miss., secretary, and Gen. Ralph H. Wooten, Mid-South Chemical Co., Memphis, treasurer.

A trade organization for the growing anhydrous ammonia industry, the association has as its goal the co-ordination of information about the use and application of the fertilizer. It is expected, too, to be the means through which the members can make their appeals for priorities

FARM PORTRAIT NO. 13

The farmer takes to the air.

The airplane has made possible some remarkable advances in pest control. Less dramatic, but fundamentally far more important, have been the advances in the wise use of suitable fertilizers to maintain soil fertility. Many of the best of these farm fertilizers are compounded with potash—often with Sunshine State Potash, a product of New Mexico. For potash is not only a vital soil nutrient, but a crop stimulator as well.

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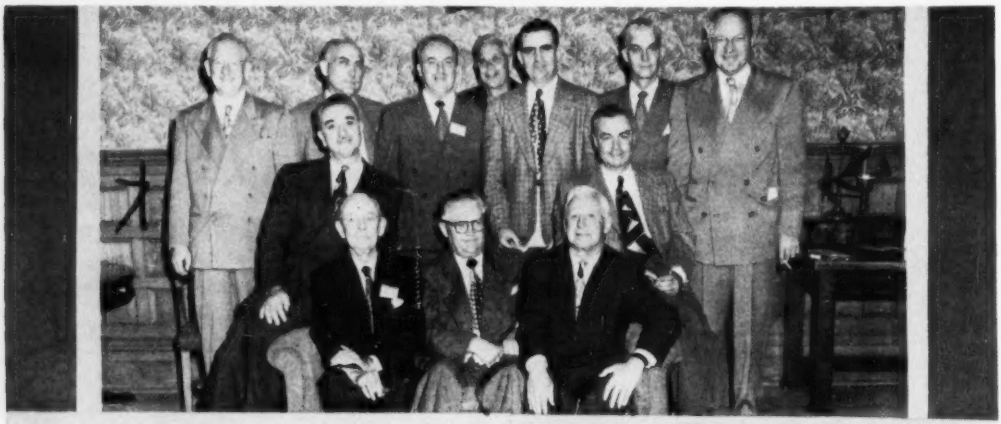
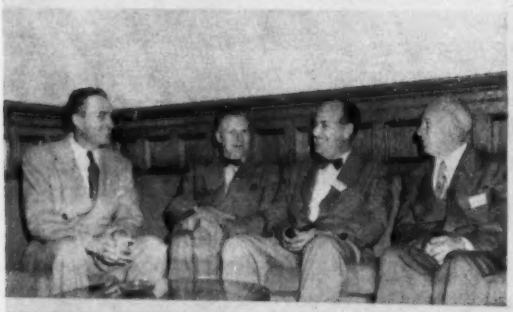
PICTURES FROM CFA CONVENTION

1. Officers and directors of the California Fertilizer Association: First row: Paul Pauly, Pacific Guano Co., retiring after 23 years as secretary; Grover Dunford, Inland Fertilizer, retiring treasurer; Wallace Macfarlane, Pacific Guano, director. Second row: Chas Monoogian, Downey Fertilizer Co., director; Ralph Crum, Pacific Guano Co., director. Third row: Elmer S. Nelson, Manager CFA; S. B. Tatem, Swift & Co., director; James Quinn, California—Sun Fertilizer Co., new President; B. H. Jone., Sunland Industries, director; Lowell W. Berry, Best Fertilizers, director; New Lewis, Wilbur-Ellis Co., director; Earl R. Mog, Growers Fertilizer Co., Director.
2. Dr. Russell Coleman, N.F.A.; H. B. Mann, American Potash Institute, Washington, D. C.; D. J. Raden, Swift & Co., Los Angeles; Elmer S. Nelson, CFA Manager.
3. Roy Mason, and A. G. Park, Consolidated Chemicals Co.; Charles Carlson and R. E. Neidig, Balfour, Guthrie & Co.
4. Weller Noble, Pacific Guano Co., Berkeley; W. J. Murphy, American Potash and Chemicals Co., New York; B. H. Jones, Sunland Industries, Fresno; Elmer S. Nelson, CFA Manager.
5. Dr. Vincent Sauchelli, Davison Chemical, Baltimore; S. B. Tatem, Swift & Co., Los Angeles; Dr. Russell Coleman, NFA; Allen B. Lemmon, Chief, California Bureau of Chemistry.





on chemicals and other materials more effective.

Directors of the association are:

One year: Henry A. Vann, Dixie Guano Co., Laurinburg, N. C.; J. L. Brooks, Midtex Liquid Fertilizer Co., Waco, Texas; M. B. Raub, Chalmer, Ind.; Charles H. Boylan, the Weatherhead Co., Cleveland, Ohio; F. H. Leavitt, Shell Chemical Co. San Francisco, Calif.

Two years: Marshall Ballard, Jr., American Vegetable Oils Co., Lumberton, Miss.; Louis A. Windham, Louisiana Agricultural Supply Co., Baton Rouge, La.; M. C. Craft, Midwest Fertilizer Co., Springfield, Ill; T. J. Bartlett, Nitrogen Fertilizer Co., Owensboro, Ky.; Hampton Pugh, Pugh Gin and Fertilizer Co., Tillar, Ark.; W. D. Tucker, John Blue Co., Huntsville, Ala.; E. A. Sadler, Liquid Fertilizer & Equipment Co., Jackson, Miss.; W. J. Exum, Commercial Solvent Co., New York.

Three years: C. A. Roush Jr., Anhydrous Ammonia Co. of Texas, Elsa, Texas; E. W. Thomas, Farm Service Corp., Booneville, Mo.; Virgil Rule, Greenville Liquid Fertilizer Co., Greenville, Miss.; J. C. Berry, Louisiana Liquid Fertilizer Co., Shreveport, La.; Ralph H. Wooten, MidSouth Chemical Co., Memphis; Jeff Davis, Southeast Liquid Fertilizer Co., Albany, Ga.; Ellsworth L. Mills, Bastian-Blessing Co., Chicago; Ed H. Gill, Flint Steel Co., Memphis.

INDUSTRY ASSEMBLIES

Midwest Agronomists To Meet February 16

Fertilization and management of legume and pasture meadows will be the theme of the annual meeting of Midwestern agronomists and representatives of the fertilizer industry which will be held at the Palmer House, Chicago, February 16. The conference is sponsored by the Middle West Soil Improvement Committee.

Soils research men from thirteen Midwestern agricultural colleges will be present at the meeting. Attending also will be representatives of companies in the fertilizer, farm machinery, supply and equipment industries.

Dr. Garth Volk, head of the Agronomy Department of Ohio State University, will be chairman. The program will be conducted by the agronomists.

Reports on new research developments in pasture fertilization, seeding, legume-grass mixtures, and management of legume crops and pasture meadows will be presented by six agronomists, representing all the states in the Midwestern area.

Among the speakers will be Dr. R. L. Cook, Michigan State College, representing Ohio and Michigan; Dr. G. O. Mott, Purdue University, representing Indiana and Illinois; Prof. E. N. Fergus, representing Kentucky and Missouri; Prof. Paul Burson, University of Minnesota, representing Minnesota, Wisconsin and Iowa; Prof. Kling Anderson, Kansas State College, representing Kansas, South Dakota, North Dakota and Nebraska.

One of the features of the meeting will be a special report by Dr. D. R. Dodd, Ohio State University, on his survey of pasture practices and research in 27 states, with special emphasis on the Corn Belt. During the past summer and fall, Dr. Dodd has covered an area from the Canadian border to Kentucky and from North Dakota to the Atlantic. He has also visited states in the South and Southeast to study winter grazing practices and management.

Following the reports, there will be a question and answer session in the afternoon, during which agronomists will discuss additional phases of subjects covered in their papers.

An invitation to attend the meeting has been extended to all interested men in the fertilizer industry and allied fields by Zenas H. Beers, Executive Secretary of the Middle West Soil Improvement Committee.

Kansas Fertilizer Men Met Dec. 7

Kansas State College, Manhattan, Kansas, agronomy staff members presented the results of fertilizer experiments in the last year at a meeting December 7 to which representatives of companies selling fertilizer in Kansas were invited.

Dr. H. F. Rhoades, professor

of soils at Nebraska University, presented the results of the Nebraska experiments and Malcolm H. McVickar, N.F.A., discussed "Aircraft Application of Fertilizers." Kenneth A. Spencer, president of the Spencer Chemical Co., Kansas City, Mo., and Pittsburg, Kansas, was the guest speaker at the dinner.

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300 Meet At Raleigh

Accepting invitations issued by North Carolina State, three hundred fertilizer manufacturers and allied groups attended a two-day conference December 12-13 in Raleigh, North Carolina, to hear leading members of the industry tell of the materials outlook and to discuss fertilizer grades.

J. Fielding Reed, Southern manager of the American Potash institute, Atlanta, Ga., told the group that there are large reserve deposits in New Mexico, Texas, Utah, and other Western states.

"We have many sources of potash that do not compete economically at the present time," Reed said. "If the need arose, Utah's copper smelters could supply our needs merely as a by-product. It is also possible to produce potash from sea water."

K. D. Jacobs of the U. S. Department of Agriculture asserted that "our major source of phosphate rock is still in Florida. Tennessee is second in importance with large untapped reserves in the three-state area of Utah, Idaho and Wyoming."

George W. Taylor of the Spencer Chemical company, Kansas City, Mo., described the nitrogen outlook. At present, he said, there is only one ammonia plant in the nation not in production.

FERTILIZER TAX TAG SALES AND REPORTED SHIPMENTS
(In Equivalent Short Tons)
Compiled by The National Fertilizer Association)

	October		November		January-October		July-October	
STATE	1950	1949	1950	1949	1950	1949	1950-51	1949-50
Virginia	49,512	45,148	20,189	13,569	643,653	642,073	131,871	148,086
N. Carolina	1/	74,044	1/	38,123	1,621,707	1,411,861	196,913	150,975
S. Carolina	45,440	40,190	83,355	49,598	835,615	860,714	130,000	98,142
Georgia	60,583	67,042	88,684	45,493	1,084,826	1,143,215	128,521	126,793
Florida	97,626	98,482	148,351	112,455	828,222	745,564	258,074	230,101
Alabama	43,549	40,913	56,085	42,522	936,199	970,266	111,904	93,414
Tennessee	12,122	25,122	37,513	27,177	438,427	420,907	65,689	60,175
Arkansas	11,672	10,544	12,622	14,650	331,240	301,895	41,110	34,718
Louisiana	18,867	13,311	17,813	11,292	247,669	219,707	43,188	34,552
Texas	79,540	54,771	43,458	52,923	506,304	424,538	174,774	134,690
Oklahoma	10,846	8,011	1/	2,307	132,797	119,891	44,485	48,881
TOTAL SOUTH		477,578		410,109	7,606,659	7,260,631	1,326,529	1,160,537
Indiana	34,540	17,985	97,590	62,916	715,338	609,559	249,849	244,239
Kentucky	22,961	15,830	31,240	29,754	499,755	407,252	100,348	82,583
Missouri	18,718	16,947	8,491	2,010	474,519	433,717	181,804	147,310
TOTAL MIDWEST	76,219	50,762	137,321	94,680	1,689,612	1,450,528	532,001	474,132
GRAND TOTAL		528,340		504,789	9,296,271	8,711,159	1,858,530	1,634,669

1/ Not available for this issue.

ORGANICS: In general, for fertilizer use, are in tight market position with none of the producers offering. Nitrogenous Tankage prices are nominally $4.50 to $5.00 per unit of Ammonia f.o.b. Domestic Production Points, with imported Nitrogenous Tankage relatively scarce and priced at around $5.75 unit of Ammonia in bags exvessel Atlantic Ports.

CASTOR POMACE: Current quotations for Domestic materials are at $5.50 per unit of Ammonia in bags, f.o.b. Northeastern Production Points, for material guaranteed minimum 5.75% Ammonia.

DRIED GROUND BLOOD: Chicago and New York markets are currently around $9.00 per unit of Ammonia, in bulk with rather limited activity noted.

POTASH: Production remains at

(Continued on page 44)

IT'S LION FOR ONE STOP Nitrogen Service FOR FERTILIZER MANUFACTURERS

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Lion Nitrogen Fertilizer Solutions — Made specifically for the manufacturing of mixed fertilizers, these products supply both ammonia nitrogen and nitrate nitrogen in the ratios desired. They are easily handled and available in three types designed for varying weather conditions, and for formula requirements in the production of fertilizers that cure rapidly, store well and drill evenly.

Lion Ammonium Nitrate Fertilizer — The improved spherical white pellets in this product contain a guaranteed minimum of 33.5% nitrogen. They flow freely, resist caking and store much better. Lion Ammonium Nitrate Fertilizer is shipped in 100-pound, 6-ply bags with two moisture-proof asphalt layers.

Lion Sulphate of Ammonia — This new, superior-type sulphate is guaranteed to contain a minimum of 21% nitrogen. Through special conditioning of the larger crystals, moisture and free acid content is greatly reduced. These factors, together with the special coating applied, make for greater resistance to caking in shipment or in storage. This product flows freely. It is shipped in bulk and in 100-pound, 5-ply bags laminated with asphalt.

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In the Field of

FARM CHEMICALS

COMBINATION FERTILIZERS AND PESTICIDES

Combination Fertilizers and Pesticides[1]
By A. L. MEHRING[2]
Division of Fertilizer and Agricultural Lime
Bureau of Plant Industry, Soils, and Agricultural Engineering
Agricultural Research Administration
U. S. Department of Agriculture
Beltsville, Maryland

In recent years special uses for fertilizers have developed rapidly. It has been found that some fertilizer materials serve also as pesticides when used in certain ways. Some economic poisons likewise have value as sources of plant nutrients. Special purpose mixed fertilizers which contain added chemicals that are primarily insecticides, fungicides, or herbicides have appeared on the market. Some of these developments are so new that they are not widely known, but they are of real interest to farmers, horticulturists, agronomists, soil scientists, plant pathologists, manufacturers of fertilizers and pesticides, state control officials, and others.

This paper briefly reviews the developments in these fields and indicates some of the problems that such developments have created.

FERTILIZER MATERIALS AS PESTICIDES

Methods and rates of application have been developed by use of which certain fertilizer materials may serve not only as a source of nutrients, but also to eradicate weeds or prevent the growth of fungi. The next two sections of this paper deal with fertilizers. Mixed fertilizers with added pesticides are discussed in a subsequent section.

Herbicidal Fertilizer Materials

Water-soluble salts may kill plants when applied to their foliage either as a strong solution or as a fine dry powder, provided the application adheres to the leaves. Finely powdered kainit has been used for many years in Germany to destroy weeds and simultaneously to fertilize cereal crops. In the British Isles ammonium sulphate solution is sprayed on winter crops for similar purposes. The selective action of the fertilizer salt results from its adherence to the foliage of the weeds but not to that of the cereals (34).[3]

"Lawn sand" has been used in Europe for a long time to fertilize grass and kill weeds, such as plantain, dandelion, and daisy. It is prepared by mixing 1 part each of ammonium sulfate and iron sulfate with 4 parts of sand. Long and Brenchley (34) give details for its use.

De France, Bell, and Odland (8) fertilized seed beds for permanent turf, such as lawns and golf greens, and also rendered them comparatively weed free by applying from 50 to 200 pounds per 1,000 square feet of lawn of either ammonium nitrate, ammonium sulphate, sodium nitrate, calcium cyanamide or urea in the spring and planting the seed in the following fall. In the quantities mentioned, all of these fertilizers reduced the number of weeds, but some were sufficient at lower rates than others. For example, about the same results were obtained with 90 pounds of cyanamid as with 185 pounds of ammonium sulfate.

Carr (2) in 1943 showed that a fall application of 1 pound of calcium cyanamide per square yard of tobacco seed bed in Georgia reduced the weed population in the following spring to 13 percent of that on the check plots. Bright tobacco seed planted 90 days after the treatment germinated well and produced very good plants. This treatment proved unsatisfactory, however, with cigar tobacco in Massachusetts (27).

Sweet (52) applied calcium cyanamide (150 to 200 pounds per acre) as a dust on the soil surface over newly planted onion seed and materially reduced the later need for hand weeding. Lachman (29) found that similar treatments made hand weeding unnecessary for potatoes and peas. Wolf and Ahlgren (54) applied granular cyanamide (600 pounds per acre) to corn just before emergence, and not only completely controlled weeds for 3 weeks, but also doubled the yield of grain. Grigsby and others (20) demonstrated that cyanamide at rates of 75 to 100 pounds per acre applied to the leaves of weeds in asparagus fields when wet with dew killed the weeds and benefited the asparagus. This treatment has largely supplanted the former practice of applying salt or kainit to this crop.

1 This paper was presented at the meeting of the Plant Nutrients Division, American Society of Agronomy, at Cincinnati, Ohio, November 2, 1950.
2 Senior Chemist. Credit is due K. D. Jacob for valuable suggestions in the preparation of this report.

3 Numerals in parentheses refer to "Literature Cited" page 39.

De France (7) prepared weed-free compost by thoroughly mixing Cyanamid with it at a rate of 13 pounds per cubic yard. In addition the quality of the compost as a fertilizer was markedly improved.

Woltz, McCants, and Neas (56) recently proposed the use of a 16-8-2 mixed fertilizer containing one-fifth of the nitrogen in the form of calcium cyanamide and four-fifths as urea for sterilizing tobacco seed beds and fertilizing the plants to be grown later. The North Carolina agricultural officials included such a fertilizer in their 1950 list of permitted grades, and it is already produced by several manufacturers.

Sulfuric acid is used to kill weeds, and at the same time it supplies nutrient sulfur. Newhall and others (42) found a 2-percent solution to be harmless to onions, but lethal to most weeds. Dilute acid may be sprayed without injury onto plants with waxy-surfaced leaves that are not wetted by it.

Korsmo (28) has reviewed hundreds of experiments on the control of weeds among cereals. In general, better weed control and higher crop yields were obtained by applying either nitric acid, sulfuric acid, or calcium cyanamide than by harrowing.

Fungicidal Fertilizer Materials

Urea, sulfur, and the minor-element fertilizers also have fungicidal properties under certain circumstances. In fact most of these materials, except urea, are used more widely as fungicides than as fertilizers. Accordingly, the minor-element fertilizers are discussed in the subsequent section on nutritional fungicides.

McClellan (41) found that urea greatly reduced losses of larkspur plants from crown rot. Similarly, heavy application of urea to tobacco seed-beds reduce infection of the plants with fungous diseases (56). When Palmiter (44) added urea to insecticidal sprays for apples for the purpose of feeding the trees through the foliage, not only was growth promptly stimulated, but apple-scab infection was reduced.

SUMMARY

A review is presented of recent developments in the use of, (1) fertilizer materials as combination weed-eradicators or fungicides, (2) nutritional pesticides, and (3) mixed fertilizers that contain added economic poisons.

Kainit and various nitrogenous fertilizer salts are used in specified ways to kill weeds. Most of the minor-element fertilizer materials and some of the secondary-element fertilizers, such as sulfur, are also widely used as fungicides.

Some of the new herbicides, such as potassium cyanate and ammounium sulfamate, and the organic phosphorus insecticides decompose in contact with moist soil and form compounds that supply plant nutrients.

The addition of 2, 4-D, various chlorinated hydrocarbons, and other insecticides and fungicides to commercial fertilizers is a promising new field for research and development. In 1949 relatively little of such mixed fertilizers was sold, but in 1950 sales are estimated roughly at about 10,000 tons.

These developments have created new problems, which are pointed out.

PESTICIDES AS SOURCES OF NUTRIENTS

Certain materials used primarily to control weeds, insects, or plant diseases also supply plant nutrients. Herbicides of this kind include potassium cyanate and ammonium sulfamate. Bordeaux mixture and many other fungicides supply secondary or minor nutrients. Borax is used as a weed-killer, fungicide, and minor-element fertilizer. Insecticides of this class are parathion and other organic phosphorus compounds which, however, are of only slight value as sources of nutrients because of customary low rates of application.

Nutritional Herbicides

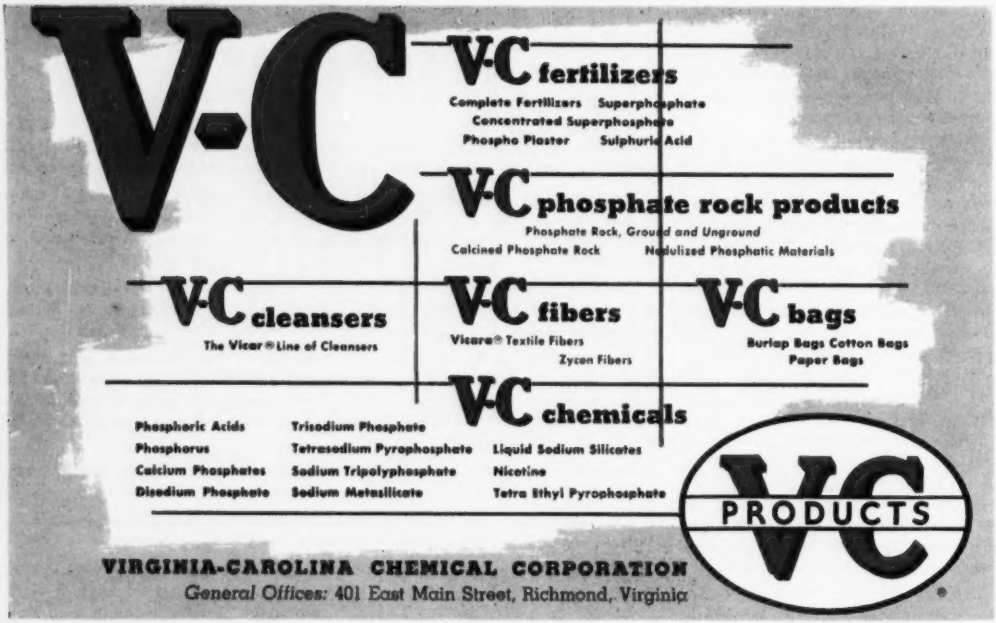
Potassium cyanate kills some plants, but not others, when sprayed as a solution onto their foliage. Fink and Stark (13) report that potassium cyanate is promptly decomposed in normal soils to form ammonia and potassium carbonate, both of which are fertilizers. Cyanates have no herbicidal effects, however, when applied to the soil in mixed fertilizers. They must be applied to the leaves in solution in order to kill the plants sensitive to them.

Hedlin (24) found that a 2-percent solution of potassium cyanate killed most weeds growing among onions, but stimulated the growth of the latter. Cyanates have been used also to kill weeds in fields of asparagus, cabbage, cotton, flax, gladioli, peas, soybeans, sugar beets, and tomatoes (20, 29, 59).

Engel (11), and Nutter and Cornman (43), as well as other workers, obtained satisfactory control of crab grass in lawns with potassium cyanate. It is also said to kill chickweed, smartweed and some other weeds that frequently mar the beauty of lawns. Wolf, Engel and Ahlgren (55) have reviewed experimental work on the eradication of crab grass with chemicals.

A dozen brands of crab grass killer, which contain potassium cyanate as the active ingredient, are on the market under various trade names. The recommended rate of application is usually from 10 to 20 pounds per acre. A 20-pound application supplies 3.4 pounds of nitrogen and 11.6 pounds of potash (K_2O).

Ammonium sulfamate in solution kills many kinds of plants when applied as foliage sprays. When the



sulfamate reaches the soil it quickly decomposes to form ammonium sulfate and ammonia. The recommended rate of application, 75 pounds per acre, provides 21.8 pounds of nitrogen and 24.8 pounds of sulfur.

Often the most troublesome plant in orchards is poison ivy. It is also found climbing trees or shrubbery in home gardens. Stoddard (51) explains how sulfamate may be used to kill this pest when growing on trees or among desirable plants and at the same time fertilize the latter.

Borax is widely used to kill weeds. It is also used to remove all vegetation on areas such as driveways, railroads and tennis courts. According to Grigsby and coworkers (20) borax does not leach readily from the soil so that areas that have been cleared of vegetation by it usually remain bare for 6 months to 3 years.

Nutritional Insecticides

The organic phosphorus insecticides, such as parathion, tetraethyl pyrophosphate and octamethyl pyrophosphoramide are not only highly toxic to insects but also to animal life in general. Hall (21) gives an excellent review of the available information on the chemistry and insecticidal properties of these compounds. Their toxicology is discussed by Lehman (31). MacIntire and associates (36) demonstrated that most of these compounds are converted to inorganic orthophosphate in the soil. With one exception (tricresyl phosphate) the six compounds tested caused very substantial increases in plant growth, even at rates of application as high as 320 pounds per acre, but they were not quite as effective as superphosphate. Ordinarily only a few pounds at most of insecticides, such as parathion, would be applied per acre, and therefore they are of very little importance as sources of plant food. Some of the organic phosphorus compounds, however, are much less toxic than parthion.

Turrell and Chervenak (53) by using radioactive sulfur discovered that when dusted on lemon trees to control certain insects some of it was actually absorbed into the tissue proteins of the plant and thus served as a nutrient.

Nutritional Fungicides

About 50,000 tons of sulfur, 10 million gallons of lime-sulfur solution, 3,000 tons of zinc chloride, and 40,000 tons of copper sulfate were used primarily as fungicides in 1942, the latest year for which such statistics are available. Smaller quantities of various boron, manganese, and other copper and zinc compounds were also used as fungicides, antiseptics, and disinfectants in agriculture. In addition, around 100,000 tons of sulfur, sulfuric acid, borax and sulfates of copper, manganese and zinc are used each year primarily as fertilizers. Aside from its consumption as a fungicide, sulfur is used as a plant nutrient on sulfur-deficient soils, as a soil amendment to reclaim alkali land, as an acidifying agent to make ordinary soils suitable for the growth of azaleas and other acid-loving plants, and as an insecticide.

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MIXED FERTILIZERS CONTAINING PESTICIDES

The economic poisons costimarily used before World War II were in general not useful for incorporation with mixed fertilizers. Nevertheless for some years a few hundred tons annually of various grades of mixed fertilizers that contained added lead arsenate have been made to customers' specifications by a few fertilizer manufacturers in the Middle Atlantic States. As a rule about 100 pounds of arsenate was added per ton of fertilizer.

Recently developed insecticides and fungicides are not only effective in the soil but suffice in relatively minute quantities. In fact some of them are effective at rates of less than one pound per acre when placed in the soil in the seed or root zone of a crop. It is difficult, if not impossible, to distribute one pound or less of material uniformly in the seed zone of a row crop. Selective herbicides too are applied at very low rates and can be distributed more evenly over a lawn or in a grain field when diluted. Of course a number of means of dilution are available. The manufacturer can dilute the poison to a point where it can be easily distributed or the farmer may dilute it with water, sand or other material on the job. If fertilizer is a practical diluent, two jobs may be combined with much less trouble and expense for the user. Thus economical combinations seem possible that would be a distinct advantage to the consumer, provided that the fertilizer and poison are compatible and that simultaneous applications give satisfactory results with both. During the past few years a number of investigators have explored these possibilities and obtained promising results.

Herbicidal Mixtures

One of the most effective weed-killers, and also a very selective one, is 2,4-dichlorophenoxyacetic acid, popularly known as 2,4-D. A number of forms of 2,4-D are on the market including the sodium salt and various esters and amines. The sodium salt is more soluble in water and less volatile than the other forms. When uniformly applied at recommended rates all of these forms kill many broadleaved weeds, but do not appear to harm most well-established grasses. Lachman (29) describes experiments with 2,4-D on the control of weeds in turf.

Small amounts of 2,4-D in mixed fertilizers had no noticeable effect on soil microorganisms in tests made by Lewis and Hamner (33). Leone and Brennan (32) conclude that 2,4-D, in the concentrations ordinarily used, loses its herbicidal properties in the soil within 80 days.

Although 2,4-D does not appear to harm mature sugar cane, Burr and Ashton (1) found it harmful to germinating seed pieces. Longchamp and Gautheret (35) in France increased grain yields by applying 2,4-D in mixed fertilizer at planting time, but decreased yields by applying the 2,4-D later as a spray on the growing plants. A 21 percent increase in yield of wheat was

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obtained by Matskov and Podrazhanskaya (40) over that with fertilizer alone by adding 2,4-D. Yields of beets and oats were substantially increased in the same way.

Marth, Hardesty and Mitchell (38) showed that 2,4-D loses none of its herbicidal properties when mixed with ordinary fertilizer chemicals under the conditions to which ammoniated commercial mixtures are ordinarily exposed.

The first brand of commercial mixture containing both 2,4-D and fertilizers appeared on the market in 1947. Others soon appeared, and by July 1950, 10 different brands were registered for sale in the various States. Typical brands, such as 7-11-5, 10-6-4, 6-10-4 and 5-10-5, usually contain from 0.5 to 1 percent of 2,4-D.

The advantages in combining 2,4-D with mixed fertilizers are listed by Kephart (26) as follows: (1) two jobs done in one operation; (2) no special spray outfit required for the 2,4-D; (3) less danger of killing nearby plants; and (4) no fumes to contaminate seeds, plants, and fertilizers for sensitive crops during storage. The disadvantages of the combination against using both separately are: (1) 2,4-D costs relatively more in the mixtures; (2) use of the fertilizer is limited to lawns and other turf; (3) danger to other plants of selecting wrong package of fertilizer; (4) waste in applying 2,4-D to spots requiring only fertilizer; and (5) the best time to kill weeds with 2,4-D is not the best time to fertilize grass. A disadvantage to the fertilizer manufacturer is that it is necessary to thoroughly clean the entire mixing unit after making a batch of mixed goods containing 2,4-D or else to reserve a unit solely for the preparation of such mixtures, because of the generally high degree of toxicity of 2,4-D to economic plants other than the grasses.

Insecticidal Mixtures

In 1944 dichloro-diphenyl-trichlorethane (DDT) was introduced as the first of a series of insecticides of a new type, the chlorinated hydrocarbons. In addition to DDT, the better known insecticides of this class include BHC (benzene hexachloride), lindane (the gamma or active isomer of BHC), chlordan, toxaphene (chlorinated camphene), methoxychlor, aldrin, and dieldrin. The chemistry of the chlorinated hydrocarbon insecticides is discussed by Haller (22) and their toxicology by Lehman (31). Additional information on toxaphene is given by Roark (46) and on aldrin and dieldrin by Rohwer (47, 48).

It appears that soil organisms do not readily decompose any of these materials, except toxaphene. Smith and Wenzel (49) and some other workers give evidence that toxaphene is slowly decomposed in the soil. At heavy rates of application BHC and chlordan kill fungi and nitrifying organisms in the soil, but DDT has little effect. On the contrary toxaphene appears to serve as food for bacteria and fungi (49). Foster (17) and others have shown that many of these insecticides persist in the soil for long periods of time. DDT and dieldrin seem to be especially persistent. For example,

DDT killed Japanese beetle grubs 5 years after being added to soil in experiments made by Fleming (15).

Several of the chlorinated hydrocarbons impart to certain crops unpleasant or offensive musty flavors, which cannot be removed by practical treatments. For instance, Greenwood and Tice (19) found that potatoes had a slight musty flavor when grown on land to which only 1 pound of BHC had been applied a year earlier. Off-flavors and other undesirable effects on certain crops grown with chlorinated hydrocarbons are reported by Cullinan (5), Stitt and Evanson (50), Crowell and Morrison (4), and many other investigators. On the other hand, these compounds, which are relatively cheap and very effective soil insecticides, do not give unpleasant flavors to corn and various other crops. They have been recommended, therefore, for inclusions in fertilizers for certain crops.

The chlorinated hydrocarbons are compatible with fertilizer materials and do not lose their effectiveness when stored in fertilizer mixtures at normal temperatures, as indicated by the work of Fleck and Haller (14), Compton (3), and Hayslip (23). Rohwer (48,49) states that aldrin and dieldrin are compatible with ordinary fertilizer materials. All of the chlorinated compounds mentioned above, except aldrin and dieldrin, are inactivated by alkalis at ordinary temperatures. Most of these materials are slightly volatile at ordinary temperatures and much more so at elevated ones. DDT decomposes rapidly at 70°C. when mixed with dolomite, magnesia, or ammonia. Parker and Beacher (45) found that toxaphene decomposes at the boiling point of water and in the presence of certain iron compounds at even lower temperatures. When ammoniated, the temperature of mixed fertilizers may exceed 100°C. Obviously, therefore, these insecticides should not be added to fertilizers prior to ammoniation. Manufacturers report that it is best to apply the insecticide to cured mixtures. Chlorinated hydrocarbons are insoluble in water and, therefore, cannot be incorporated into fertilizer mixtures as water solutions. Correspondence with companies that have experimented with various procedures in manufacturing such goods indicates that the most practicable method is to add the insecticides in the form of a 10 or 20 percent dust concentrate.

Lawn fertilizers containing guaranteed amounts of insecticides have been on the market for several years. Most of these are small package goods, such as 15-8-4 fertilizer manufactured in California that also contains 1 percent DDT, and 10-10-5 grade that in addition supplies 0.25 percent lindane. An 8-6-4 lawn fertilizer manufactured in Connecticut is also recommended for Japanese beetle control. It contains 2.5 percent DDT, 2 percent chlordan and 1 percent Japanese beetle milky-disease spore dust.

Fulton (18) in 1946 suggested applying insecticides and fertilizers together to control corn rootworm. Since then Floyd and Smith (16), Marcovitch and Stanley (37), Farrar (12), and many others have experimented with

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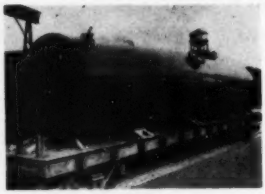

STEEL TANK
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16,500 Gallons

field-crop fertilizers containing insecticides. Some of this work is reviewed by Woodle and Nettles (57).

Good yields of corn have been obtained on land previously abandoned, because of infestation with corn rootworms or sand wireworms, by adding as little as ¼ pound of lindane or ½ pound of chlordan per acre in the mixed fertilizer used. It is apparent from the foregoing discussion, however that fertilizers containing powerful insecticides should not be use indiscriminately.

Farm fertilizers containing insecticides of various kinds were prepared on a customs basis in New York, New Jersey, Maryland, South Carolina, and Florida on a small scale in 1949. Some grades of mixed fertilizer with guaranteed contents of insecticides and recommended especially for corn are now also carried in stock by a few manufacturers and dealers. The insecticide most widely used in 1950 in mixed fertilizers appears from reports from a number of the companies selling such goods to have been chlordan. It is estimated that between 5 and 7 thousand tons of field-crop fertilizers containing insecticides were sold in South Carolina alone in 1950 and several thousand tons more in the remainder of the country. A number of companies that did not sell such goods in 1950 have announced their intention to do so in 1951.

Fungicidal Mixtures

Many different fungicides have been added to fertilizers in experiments. Doran (9) tested more than a dozen kinds in combination with 5-8-7 fertilizer and in general obtained better results with the mixtures in controlling certain fungous diseases than when fertilizer and fungicide were applied separately. Other experiments are reported by Zentmyer, Horsfall and Wallace (58), Cunningham and Wessels (6), Doran and Sproston (10), Hildebrand, McKean and Koch (25), Leach and Synder (30), and Martin (39). The fungicides tested include various mercury compounds, copper-8-quinolinolate, 8-hydroxyquinoline benzoate, sulfur, Fermate, Dithane, and Arosan. Although these and other experiments indicate that commercial fertilizers containing various specific fungicides might be very successful, only one is known to the writer to be on the market. This is a lawn fertilizer containing phenyl mercuric acetate, which is recommended for the control of fungous diseases of grass.

Multiple Purpose Mixtures

Among commercial lawn fertilizers that include chemicals to control both weeds and insects is a 7-5-5 mixture that is guaranteed to contain 1 percent 2,4-D and 0.25 percent lindane. An even more complex mixture, introduced in New York in 1950, is said to consist of grass seed, compost, chemical fertilizer, chlordan, milky-disease spore dust, a fungicide, a crab grass killer, and a weed eradicator.

Regulatory Aspects

Some of the economic poisons

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mentioned above, if improperly used, may kill human beings or domestic animals, or damage crops or soils. Precautions are necessary therefore, when they are added to fertilizers. Manufacturers must include directions on the package for proper use and warnings against improper use, or they will be liable for any damage that results from the use of fertilizers containing pesticides. Fertilizer mixtures containing added persticides must conform with the requirements of the economic poison laws of all States in which they are offered for sale. Interstate shipments must be preceded by registration with the Production and Marketing Administration, U. S. Department of Agriculture.

Louisiana prohibits the sale of mixed fertilizers containing 2,4-D, but it appears that this material may be legally added to mixed fertilizers in all other States.

The agricultural authorities of both Virginia and North Carolina will not register mixed fertilizers containing BHC. On the other hand, South Carolina will register fertilizers containing chlorinated hydrocarbons on the condition that the package bears a red tag stating that the product is for use on corn, and that odor, taste contamination, or other damage may result from its use on other crops.

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Pennsalt Names Roeller

R. S. Roeller has been appointed to a newly created position that of assistant general sales manager in charge of the agricultural chemicals, heavy chemicals and special chemicals departments of Pennsylvania Salt Mfg. Co. He reports directly to William P. Drake, vice president

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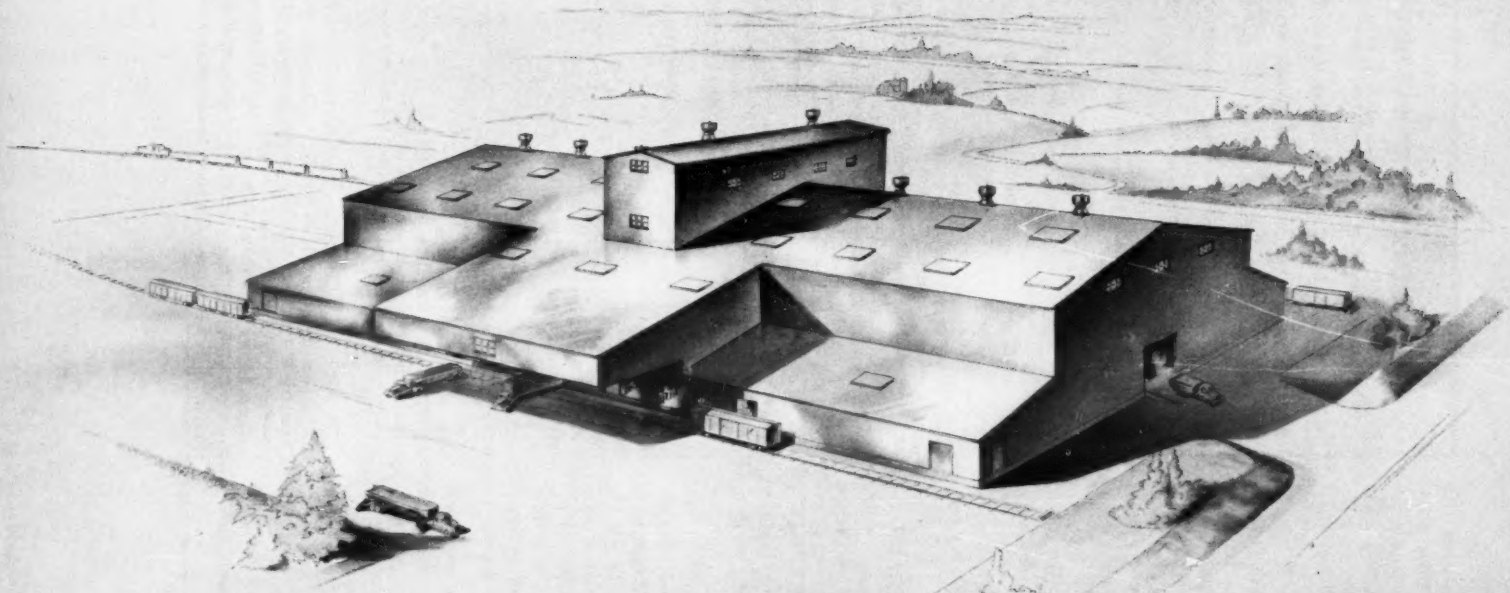

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and general sales manager. He will continue to be sales manager of the heavy chemicals department and supervise the others.

Horsfall Heads Phytopath Society

Dr. James G. Horsfall, director of the Connecticut Agricultural Experiment Station, was elected president of the American Phytopathological Society at its annual meeting held in Memphis, Tenn. The professional organization for scientists engaged in plant disease research, the Phytopathological Society has some 1,400 members representing all parts of the United States. The election is for a one-year term.

Stoddard Finds Control For Strawberry Disease

A control for the red stele disease of strawberries, for which no treatment was known before, has been developed by E. M. Stoddard, plant pathologist at the Connecticut Agricultural Experiment Station. Mr. Stoddard has obtained 100 per cent control of the disease with sub-surface applications of Dithane D-14. This chemotherapeutic method represents an entirely new approach to a root disease problem.

Powell Gives Christmas Bonuses

Christmas bonuses of as high as 11% of yearly salary were announced by Mr. H. Alvin Smith, president of John Powell & Co., Inc., New York, leading specialists in the supply of insecticide materials. This is the 20th consecutive year that Powell has issued Christmas bonuses to its employees.

MIAMI BEACH SCENE OF N A C MEET APRIL 4-6

While the final list of speakers had not been released as this issue went to press, it is definite that leading lights of the industry itself, the USDA, and other governmental agencies concerned with use and control of farm chemicals, will be speakers at the Spring meeting of the National Agricultural Chemicals Association. The gathering will be held April 4-6 at the Flamingo Hotel, Miami Beach, Florida.

The Hawaiian Sugar Planters' Association is experimenting with pellets containing 2,4-D weed killer as a means for overcoming trouble caused by the drift of liquid sprays carrying 2,4-D.

Association experiment station agronomy and chemistry researchers have reached preliminary trial stages with several types of pellets. To make one kind, 2,4-D is attached to ammonium phosphate. In another type, 2,4-D is attached to fine volcanic cinders.

Experiments show the pellets have controlled weeds by pre-emergence for as long as eight weeks. Pellets that gradually release 2,4-D to the surface for several weeks have remained effective longer than those that go into solution when they meet moist soil or irrigation water.

Pellets have been applied successfully from airplanes. Field tests at three plantations have led to further testing.

The experiment station's physiology and biochemistry department has been experimenting with radioactive 2,4-D. For the first time, the department has been able to say to what degree the chemical is absorbed by the plant and transported.

* * *

R. Q. Smith, president of **Pacific Chemical & Fertilizer Co.,** Honolulu, recently completed a two month business trip to New York, Washington, D. C., Philadelphia and Pittsburgh, Pa., and Montreal, Canada.

Mr. Smith noted developing shortages in insecticides, chlorine and most coal by-products. But he forecast ample fertilizer supplies for Hawaii unless unforeseen factors develop.

Mr. Smith heads Hawaii's largest fertilizer producing and importing firm. He expressed particular interest in Washington hearings on restrictions in shipments of ammonium nitrate. Loading or unloading of ammonium nitrate is currently prohibited in all but six island ports.

* * *

A liquid fertilizer that turns to gas when applied will be used in the coming year by the **Hawaiian Commercial & Sugar Co.** in its cane fields on the island of Maui.

A small hose pointed down into the furrow behind the sub-soiler will squirt the liquid into the soil. When released from pressure, the liquid will turn into heavy gas and spread into the soil.

The liquid is called anhydrous ammonia. It contains a higher percentage of much-needed nitrogen than did the dry ammonium nitrate and sulphate of ammonia Hawaiian Commercial & Sugar formerly used.

Anhydrous ammonia will be used for the first fertilizer application on all ratoon cane fields except those needing phosphate as well as nitrogen.

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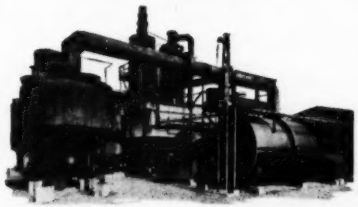

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EQUIPMENT

(Continued from page 19)

crops, in conjunction with plowing, planting, and drilling vegetable seed. The unit will, of course, operate alone, applying fertilizer on the soil surface as top dressing.

Another recent development is a pull type, end wheel broadcast fertilizer machine that consists of a series of staggered furrow openers that can be used alone or in combination with rolling coulters. The machine provides furrows up to 7 inches in depth and will space the furrows from a minimum of 6 inches up to the width of the machine. Thus, this machine can not only broadcast fertilizer, but also can place fertilizer in bands at different depths and spacings in either tilled or pasture land; can place fertilizer as a side dressing along crop rows of all normal spacings, and with a seeder added, can open the furrow, drill grass or grain seed, and apply fertilizer.

Bulk lime and fertilizer spreaders also have been improved to insure more uniform distribution of plant food, Cumings said. Most of the spreaders use horizontal rotating fans with centrifugal action or lateral screw conveyor troughs with a series of delivery openings.

Bemis Offers Guide For Bag Users

"Multiwall Packaging Guide," a twenty-page booklet describing and illustrating ways to use all types of multiwall paper bags more efficiently and economically is just off the press and is being distributed by Bemis Bro. Bag Co. Copies of the booklet may be obtained by writing them at 408 Pine Street, St. Louis 2, Missouri.

Equipment Manufacturers Form Organization

Farm equipment manufacturers from ten Southeastern states have formed a Southern manufacturers organization to be known as Southern Farm Equipment Manufacturers, Inc. The Atlantic Steel Company, Atlanta supplier of unfinished and semi-finished steel to this rapidly growing industry, acted as host to the farm equipment group. All meetings were held in Atlantic's company auditorium.

Robert S. Lynch, Atlantic Steel president was temporary chairman of the steering committee which planned the organization.

MARKETS

(Continued from page 30)

capacity levels but movement has been interrupted sometimes seriously by car shortages and the recent Rail Strike is delaying deliveries considerably.

GROUND COTTON BUR ASH: This source of Potash largely in the form of Carbonate of Potash testing 30 to 40% K_2O is in relatively limited supply due to the short Cotton Crop this year. Some supplies are available however, for Spring movement.

PHOSPHATE ROCK: Domestic movement against existing contracts is somewhat curtailed due to the shortage of Sulphuric Acid. Foreign interest in United States Phosphate Rock is reduced because of higher Ocean Freight.

SUPERPHOSPHATE: There are no sellers of surplus Normal Superphosphate in the Southeast. Shortages exist in the West and Midwest, and the overall picture is that Superphosphate both Triple and Normal are extremely tight; prices in the Baltimore area recently advanced 5¢ per unit on Normal Superphosphate with some sellers withdrawing from the market.

SULPHATE OF AMMONIA: Both the Steel Mills and one of the Synthetic Sulphate of Ammonia producers have advanced their prices with coke-oven material increased by $8:00 per ton and Synthetic $9.20 per ton at the Ports. The $9.20 increase becomes effective in February on contracts.

AMMONIUM NITRATE: Supply and demand are much out of balance with the market extremely tight. Another Domestic Producer has announced an increase of $3.00 per ton.

NITRATE OF SODA: Supply position is comfortable and prices unchanged. Demand is seasonal.

GENERAL: Superphosphate in all forms is in tight positions. Potash movement is being hampered by car shortages and Railroad Strikes. Sulphuric Acid is far short of demand, and all forms of Nitrogen are tending to tighten in supply with prices of many of them recently advanced.

U. S. Stoneware Releases Brochure

U. S. Stoneware Company, Akron, Ohio, have just issued a beautifully printed and well illustrated brochure covering their complete line of Grinding and Mixing equipment. The book is filled with illustrations and specifications are presented in easy to read form. The members of the industry can obtain a free copy of this brochure by writing for Bulletin 265, to U. S. Stoneware Co., Process Equipment Division, Akron 9, Ohio.

Bauer Bros. Issues Bulletin

Bauer Bros. Company, have issued a four-page two-color bulletin describing their Hammer Mills. Copies of this bulletin will be gladly sent upon request to the Company, 1794 Sheridan Avenue, Springfield, Ohio. Ask for Bulletin H-5.

Mostly Personal

Ray C. Ellis (New Albany, Ind.) Christmas-cards that he was headed by plane for L.A., for a 2-week visit "with my **Virginia** and my son **Stanley** and their families."

* * *

Frank S. Moore has been elected vice-president of **F. S. Royster Guano Company,** Norfolk, Virginia.

* * *

Lewis R. Sanderson was elected vice-president and chairman of the policy committee; **Fred A. Manske** becomes vice-president in charge of manufacturing—both newly created posts for **National Gypsum Company,** Buffalo, New York. President **Melvin H. Baker** has also announced **Wade W. Hildinger** to the new post of director of trade relations, working with trade associations and dealers.

* * *

E. A. Simpson has retired as purchasing agent of the **Consolidated Rendering Co.,** Boston, after 39 years of service. He will be succeeded by **Victor A. Ericson,** Assistant for 10 years. **William C. Potter** is the new Assistant.

* * *

Mente & Co., Inc., textile bag manufacturers in New Orleans, announce these changes: **Marshall L. Harper,** formerly Assistant Secretary-Treasurer, is assistant vice-president; **J. Lucius McGehee** is assistant vice-president in charge of research and development; **E. Reid Powell,** plant manager, assumes in addition the title of assistant vice-president in charge of production.

In Mente's Savannah branch, **James A. Baggs,** Jr. has been made assistant manager, and the same title has been given to **M. P. Robertson** at the Houston branch.

Dr. M. F. Fogler, vice-president **The Solvay Process Division, Allied Chemical & Dye,** in a talk before the Chemical Market Research Association early last month pointed out that the use of synthetic nitrogen had tripled in industry during the past 10 years and that plant capacity in the same period had increased 200%. Last year, Dr. Fog-

(Continued on page 57)

PSC Notes on Karl Baur

We of Pacific Supply Cooperative are proud to announce the appointment of Mr. Karl Baur to our staff as Research Director. This appointment will take effect January 1, 1951. Karl Baur's education and field work was obtained in Washington.

He is author or joint author of some technical or popular papers and pamphlets concerned with information on soils and fertilizer usage in western Washington. The Western Washington Experiment Station has gained national recognition on the work on fertilizer placement and the studies on the fertilizer requirements of vegetable and small fruit crops grown in the area.

Baur is a member of a number of national organizations as well as local organizations interested in the agriculture of the area. He is a member of The Soil Science Society of America, The American Society of Agronomy, The American Society of Horticultural Science, The American Association for the Advancement of Science, The National Joint Committee on Fertilizer Application in which he is co-chairman of the committee on Vegetables under Irrigation. He is listed in American Men of Science and is a member of Sigma Xi. Regionally he is a member of The Western Soil Science Society, The Soil Improvement Committee of the Northwest Plant Food Association, on the board of directors of the Western Washington Horticultural Association, The Forest Soils Committee of the Douglas Fir Region of the Northwest and on the Agricultural Subcommittee on the Washington State Industrial Development Committee.

T. L. Wilkerson, who has been appointed general sales manager for the agricultural chemicals division of American Cyanamid, with whom he has been associated for 25 years.

Tom W. Brown, with long experience in the multiwall bag field, has been made Southern sales manager of Arkell and Smiths. His headquarters will be at the Mobile plant.

Dallas Cantwell, who has been appointed agronomist for the Southeastern district of Spencer Chemical Company, with headquarters in Atlanta.

FLORIDA

International Minerals and Chemicals has awarded to **Paul Smith Construction Company** the job of erecting their modern office building in Bartow at a cost of $300,000. **Robert Law Weed** is the architect. The building will be of reinforced concrete, faced with brickcrete. See Illinois and Texas for additional IM &M news.

* * *

Stukey Fertilizer Works, Pahokee, are offering an application service, according to **Orin Bocon, Jr.,** manager. Or they will rent application equipment to the farmer on a U-Drive-It basis.

* * *

Florida Favorite Fertilizer, Inc., Lakeland, are offering more than 400 analyses to meet specific crop needs. They have a staff of six field men who cover central Florida. **W. H. Stuart** is president; **J. K. Stuart,** vice-president; **M. A. Cook** is secretary-treasurer; **E. F. Murray** is manager and **J. E. Palmer** is superintendent. Their field men are **Dan Bishop, Earl McBride, Walter Burt, R. M. Marler, Jr., George W. Riddle and E. B. Hadley.** A large truck fleet has been built up for field delivery.

* * *

The Quinn Menhaden Fisheries, Fernandina, will be looking for the return of the "Porgy Fleet" from Carolina waters about the time you read this. They and the **Nassau Fertilizer and Oil Company,** also of Fernandina, are processors of menhaden for fertilizer and fish oil.

* * *

The Florida Freezer and Fertilizer Company, Stuart, no longer exists. It was organized in 1912, lasted only two weeks—and folded. The building, according to local legend was jinxed and was certainly no help to the various tenants, whose various undertakings came to untimely ends. Finally fire destroyed the old building, and Stuart citizens breathed more freely.

* * *

F. C. McKenzie, West Palm Beach, seems to be doing all right with his conversion of Everglades peat to an organic fertilizer known as Synorg. A number of big fertilizer concerns have taken his entire initial output which is around 10 tons a day, and he is building a new plant which will produce 52,000 annual tons.

GEORGIA

A. C. Samford Inc. employees, confronted suddenly by fire in their offices when an oil heater exploded, smothered the blaze with fertilizer.

ILLINOIS

International Minerals & Chemical Corporation has announced plans for the construction of a new central research laboratory to be located in Skokie, Illinois, according to Dr. Paul D. V. Manning, vice president of the corporation in charge of its research division.

The laboratory will be of modern, fireproof construction, having an area of approximately 33,000 square feet. The research staff which will occupy the building will consist of approximately 75 persons, many of whom are nationally recognized specialists in their fields.

Architect's drawing of International Minerals & Chemical Corporation's new plant food and superphosphate plant in North Fort Worth, scheduled for completion about June 15, 1951, will have an annual production capacity of approximately 40,000 tons of plant food and will represent an investment in land, buildings and equipment of approximately $500,000.

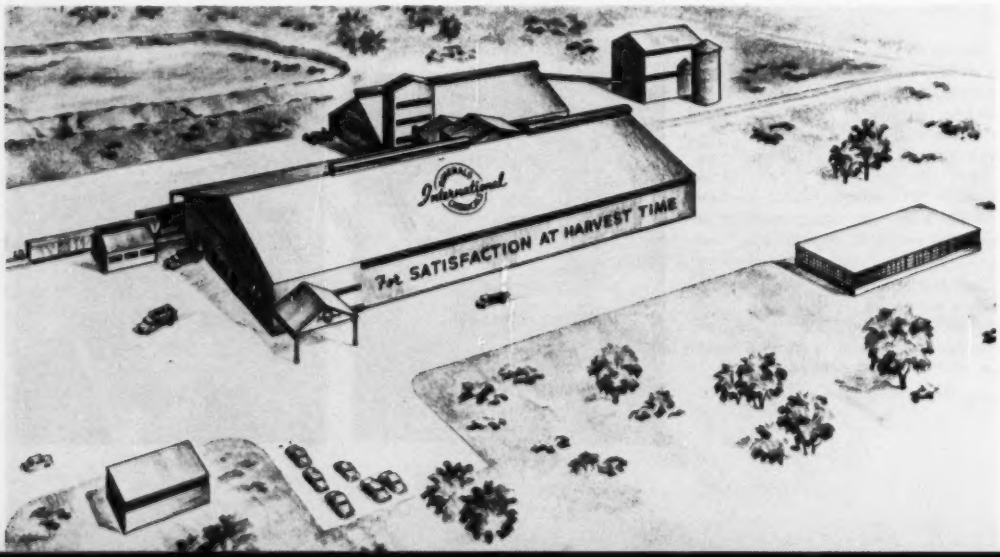
The new International plant will incorporate the most modern methods of fertilizer manufacture, including the latest materials handling systems obtainable. An overhead conveyor system will carry superphosphate from the superphosphate plant into the main mixing building; and manufacturing, bagging and storing procedures are all planned for highest efficiency and a minimum amount of delay for customers.

A canopy over one of the leading docks will make it possible to load and cover plant food regardless of weather conditions. Special facilities for customers, including rest rooms, are planned.

The plant, office building and locker house are all laid out with future expansion in mind. The offices will be one story in height and will be consistent in design with other office buildings International has erected at its other plants.

Representatives of the company who came to Fort Worth for the ground breaking ceremonies December 13 in addition to President Louis Ware, and Vice-President Maurice H. Lockwood, are Thomas M. Ware, chief engineer; J. F. Stough, northern general manager of the Plant Food Division; F. H. Perrin, Plant Food Division production manager; and H. E. Terwell, bulk sales representative of the Amino Products Division of the company, all of Chicago, and W. Q. Burns, district manager of the Plant Food Division, Texarkana, Ark.

J. R. Murphy & Co. of Fort Worth is general contractor for the new plant. A. J. Sackett & Sons of Baltimore, Md., will supply plant equipment; equipment for the manufacture of superphosphate will be obtained from Sturtevant Mill Company, Boston, Mass.; steel work will be supplied by Mosher Steel Company, Dallas, Texas; and the conveyor system will be purchased from Barber-Greene of Aurora, Ill.



Around the Map

MASSACHUSETTS

Monsanto Chemical Co., Everett, have a 150-foot, pencil-like stack on their plant. **Russell L. Miller,** plant manager was puzzled as to how it could be painted, without the laborious process of building a scaffold around it. He solved it by hiring a helicopter. In this the painters flew to the top of the stack, slung their staging hooks over the rim, and lowered the ropes to the ground. Then the painters went up in the usual bos'n's chair and did their stuff. Time for scaffold-building would have been a day and a half. Time via helicopter, 30 minutes.

MISSISSIPPI

Mississippi Chemical's anhydrous plant at Yazoo City will be in operation by March "if no further strike delays are occasioned," according to officials of the $7,500,000 farmer-owned plant. At their annual meeting, **Charles Whittington** was elected president; **Charles McNeill** and **F. W. Anderson, Sr.,** were reelected respectively first and second vice-presidents, and **Owen Cooper** was reelected executive vice-president.

MISSOURI

N. J. Cooksey Company, Moberly, have put into operation the $10,000 conveyor and storage tank for phosphate recently erected. Another tank and a 30 x 75 foot warehouse are to be built in the Spring.

NEW MEXICO

Southwest Potash Corp., Carlsbad, expects to begin operations with an initial capacity of 185,000 annual tons of potash by 1952. Their investment in this project is said to be ten million dollars. They are the fourth concern to start operations in the Carlsbad potash basin. **U. S. Potash and I.M.&C.** have been in production for a number of years. **Duval Sulphur and Potash Corp.** are now sinking a shaft and building a $7.5 million plant that will be in operation next year.

NEW YORK

Arkell and Smiths have announced completion of a $55,000 expansion at their Canajoharie bag plant. This is the final phase of a two-year program, which added warehouse and manufacturing areas, and marked the installation of equipmen which will increase the specialty bag capacity of that plant 50%.

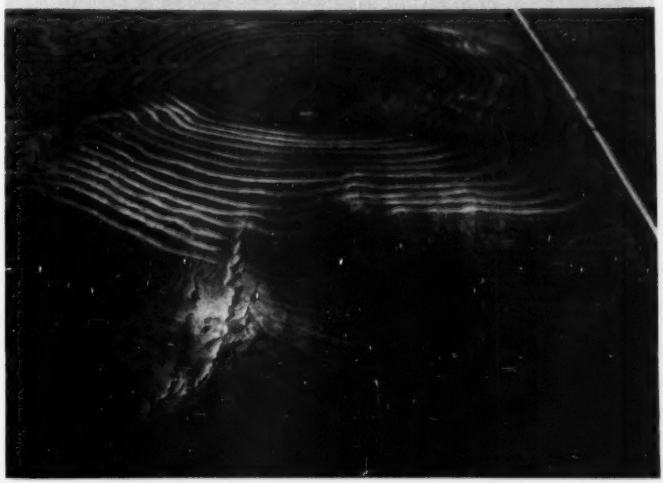
TEXAS

International Minerals & Chemical Corporation broke ground December 13 for their new plant food and superphosphate plant in Fort Worth. As a part of the ceremony a specially inscribed shovel was

The airplane is playing a big part in dramatizing and spotlighting the need for soil conservation under an experimental project started recently in Central Texas. Sponsored by the Texas Aeronautics Commission, the project has shown such impressive results that it will form the basis for a statewide program. The aircraft are used to demonstrate to landowners that by personally surveying their land from the air they can get a better working knowledge of the effects of erosion and how to control it. The first aerial demonstration has stirred the interest of state and national figures in soil conservation and now a large-scale program is being planned for November at Lockhart, Texas, where these figures and the general public will get a chance to observe.

This aerial photograph, taken near Lockhart, demonstrates the worth of aerial observation. The topsoil, which may look reasonably fertile on the ground, shows up thin and in some cases bare from the air. This picture also shows where some additional contour plowing might well be done.

Planes were furnished by members of the Texas Flying Farmers, Texas State Aviation Association, Texas Private Flyers Association, the Aeronautics Commission and the local airport operator for the experimental demonstration. Above, one group of farmers is just ready to take off for the first flight of the morning.



presented to President **Louis Ware.**

Before the ceremonies, Fort Worth dignitaries and business men were guests of Mr. Ware and **Maurice H. Lockwood** at a luncheon, and that evening Mr. Ware was guest speaker at the annual banquet of the Fort Worth Chamber of Commerce.

As has been related here previously, the plant will have an annual production of some 40,000 tons of plant food, and will represent an investment of about $500,000.

In addtion to superphosphate it will produce mixed fertilizers for wheat, hay, corn, cotton, truck and pasture crops, and the location is strategic to the movement of cattlemen, who will find it a convenient place to load their trucks for the return trip, after delivering cattle to the Fort Worth stockyards. The site is also strategic, as we pointed out several months ago because it is adjacent to **Consolidated Chemical Industries, Inc.,** from whom the site was purchased, and from whose plant will come the necessary sulfuric acid. **A. J. Sackett, Sturtevant Mill Co., Mosher Steel** and **Barber-Greene** are among the concerns supplying the construction and equipment program.

* * *

The Wood Chemical Co., Lubbock, will be established shortly as an insecticide and fertilizer plant. It is headed by **W. R. Wood,** former vice president of the **Plant Food Corporation,** Los Angeles. The plant will contain 14,000 square feet of floor space.

* * *

Midtex Liquid Fertilizer Co., Waco, has donated five tons of anhydrous ammonia to the A&M Experiment Station for research on rates of application for cotton, corn, sorghum and grasses at the Bluebonnet Farm.

* * *

Pat-Mac Produce Co., La Grange, has bought out the fertilizer business of G. G. Looney, and will handle rock phosphate, 20 percent super and mixed fertilizers. **B. X. McGuire** will manage the operation.

* * *

The Pecos Valley Fertilizer and Chemical Company has started an expansion program that will virtually double their present warehouse space and will bring them a new office and chemical laboratory combined.

Plans call for an addition of 60 x 100 feet to the present warehouse at the air base, B. J. Kerley, manager, announced recently.

Present size of the building is 60 x 100 feet and the new addition will, of course, double the length of the structure.

Work began on the addition Dec. 15, with the **Armco Steel Company** of Houston handling the contracting. Cost will be about $16,000. The building will be of all-steel construction.

AUSTRALIA

The superphosphate shortages which has existed in Australia for the last two years is accentuated by a railway strike of more than six weeks duration and still not settled when our Australian correspondent wrote. Only about 75% of the need will be delivered to farmers.

Farmers in Western Australia at a recent meeting urged stockpiling of a three-year supply of phosphatic rock, as the entire economy of the State depends upon superphosphate supply.

* * *

Australian Iron and Steel Co., Port Kembla, New South Wales, has installed a crystal sulphate plant, which produces a free-running, dustless ammonium sulphate.

CANADA

Dow Chemical of Canada, Ltd. will build at Sarnia, Ontario, an anhydrous ammonia plant, which is slated to produce 15 tons a day, with provision for rapid expansion beyond that point as required.

* * *

The Consolidated Mining and Smelting Company of Canada, Ltd., has announced construction projects amounting to a total of $15,000,000. The company has decided to increase its fertilizer production by building a plant at Kimberley, B. C., with a capacity of about 70,000 tons per year of ammonium phosphate at a cost estimated at approximately $9,000,000. The new plant will include a unit for the treatment of tailings from the company's Sullivan mine to produce about 300 tons per day of sulphuric acid which will be used for the treatment of phosphate rock from the company's mines in Montana.

At Trail, the company will build an addition to its electrolytic zinc refinery at an estimated cost of about $3,200,000. This new unit will increase the production of refined zinc by about 700 tons per day and will use 15,000 h.p. of electrical energy. The extra plant capacity is required to treat the increasing quantity of zinc ores and concentrates which are becoming available from numerous mining operations in British Columbia, as well as the zinc which will be available from the Bluebell mine on Kootenay Lake and other properties owned by the company which are now being prepared for production.

In order to provide for the increased power requirements at Kimberley, the company has decided to build a high-voltage transmission line from its hydro-electric plants on the Kootenay River, a distance of about 87 miles. The cost of this line is estimated at $2,850,000.

Link-Belt Opens Pittsburgh Branch

For better service to industries in the greater Pittsburgh area, Link-Belt Company has constructed and is now operating a new factory branch store located at 5020 Centre Ave., Pittsburgh 13, Pa. This new building provides ample space for stocking Link-Belt power transmission and materials handling products and serves as headquarters for the increased Pittsburgh personnel. Otto W. Werner is District Manager.

FIELD EXPERIMENTS WITH FARMYARD MANURE AND ARTIFICIAL FERTILIZERS

ASKOV 1894-1948

By KARSTEN IVERSEN, Forstander
Askov Forsogsstation
Askov, Denmark
and
PROFESSOR K. A. BONDORFF, Director
Statens Planteavls—Laboratorium
Lyngby, Denmark

At the recent meeting of the American Society of Agronomy, in a discussion following presentation of papers in the Plant Nutrients Division, a representative of the Ministry of Agriculture of Denmark told of certain experiments in Denmark. These experiments have run continuously for 54 years, and show approximately 15% higher yield from crops fertilized with chemical fertilizer than from crops fertilized with the same amount of plant food obtained from manure. Interest was so keen that the speaker agreed to have translated a report on these experiments. The following is a translation of the article which was published in "Official Danish Journal of Plant Culture." The following extracts from this article should prove interesting to all producers of commercial fertilizer.

In 1894, field experiments on the "Loam Field" and the "Sand Field" at the Askov Experiment Station were started with the dual purpose of determining the question whether soil fertility can be maintained by the exclusive use of artificial fertilizers, and the value of artificial fertilizers in comparison with farmyard manure. The experiments are placed permanently in rotations where each crop is harvested annually. During each rotation the same average amounts of plant nutrients (nitrogen, phosphorus and potassium) have been applied as "I farmyard manure" and "I artificial fertilizer." As in ordinary farming practice, the farmyard manure has only been applied to some crops, while artificial fertilizer has been distributed to all crops of the rotation. Similar experiments have later been conducted at other State Experiment Stations: Lyngby 1910-33, Aarslev 1911-26, Studsgaard 1918-44, Lungaard 1927-46, Tylstrup 1927-46.

The present report deals with the results of the Askov experiments from 1894 to 1948, which in Chapter VII are compared with those of the experiments at the other stations.

The quantities of farmyard manure and artificial fertilizer employed in the Askov experiments were altered in 1907 and in 1923, in such a way that "I farmyard manure" and "I artificial fertilizer" constantly represent the same amounts of plant nutrients. Since 1923, "farmyard manure" means

Table 45. Askov loam-field 1923 - 1948
Fertilizer application and crop yield

	kg nitrogen per ha in fertilizer		Yield in 100 kg per ha					
			Unfertilized	Art. fertilizer			Farmyard Manure	
	1 art.f.	1 f.m.		1/2	1	1 1/2	1	1 1/2
Wheat, grain	68	0	12.6	24.8	32.9	35.8	20.7	22.7
Rye, grain	68	0	12.6	22.6	28.6	32.0	19.8	21.3
Barley, grain	50	74	13.5	27.7	35.9	39.4	27.8	32.5
Oats, grain	50	74	13.9	25.1	32.5	36.4	27.5	31.0
Mangolds, dry matter in roots	160	213	12.3	59.7	87.2	95.3	72.1	90.7
Clover-grass, hay	0	0	30.0	54.5	61.3	60.0	66.4	73.1
Average, fodder units	—	—	13.8	34.9	46.9	50.8	37.9	44.7
Average, kg	69	72	—	—	—	—	—	—

Table 46. Askov Sand-field 1923 - 1948,
Fertilizer application and crop yield

	kg nitrogen per ha in fertilizer		Yield in 100 kg per ha			
			Unfertilized	Art. fertilized		farmyard manure
	1 art.f.	1 f.m.		1/2	1	
Rye, grain	68	0	8.4	21.4	27.6	16.3
Oats, grain	50	72	8.1	21.9	28.7	21.9
Potatoes, dry matter in tubers	160	213	18.7	66.9	88.2	90.5
Swedes, dry matter in roots	160	213	25.1	65.5	74.0	77.3
Clover-grass, hay	0	0	13.6	51.4	58.4	62.8
Lupins, hay	0	0	43.7	54.4	53.7	57.3
Average, fodder units			11.4	34.0	43.4	38.5
Average, kg	70	71	—	—	—	—

liquid as well as solid manure. The experimental results have therefore been calculated for three separate periods: 1894-1906, 1907-1922, 1923-1948. The fertilizer supply and the crop yields for the last period are stated in Tables 45-46.

The rotation has been as follows: I, winter cereals—2, root crop — 3, summer cereal — 4, clover-grass ley. On the loam field the winter and summer cereals were rye and oats until 1930, and wheat and barley since then; the root crop has constantly been mangolds. On the sand field the cereals have constantly been rye and oats; potatoes have been grown as a root crop throughout the years, but since 1927 the plots have been divided into halves and swedes grown on each half-plot. Clover has been replaced by glucoside-free yellow lupins since 1943 on the sand field. Both on the loam and the sand field artificial fertilizer has given considerably higher yield than farmyard manure with the same content of nitrogen, phosphorus and potassium. Only in clover and lupins has the farmyard manure proved superior to artificial fertilizer; in the case of clover this may be due to a suppressive effect of the vigorous cereal crops on the artificially fertilized plots.

Table 47. Yield in average per rotation, 100 fodder unite.

	Unfertilized	1/2 art.f.	1 art.f.	farmyard manure
Askov loam-field 1894-1906	20.2		35.5	32.7
1907-1922	14.0		35.6	29.0
1923-1948	13.8	34.9	46.9	37.9
Askov sand-field 1894-1906	14.2		31.2	27.0
1907-1922	10.5		31.5	28.0
1923-1948	11.4	34.0	43.4	38.5
Lyngby 1910-1921	21.8	35.4	41.8	34.1
1922-1933	21.6	41.3	47.2	43.1
Aarslev 1911-1926	22.9	34.1	38.5	34.6
Studsgaard 1918-1926	13.4	20.3	25.0	22.1
1929-1944	12.7	26.2	32.8	30.1
Lundgaard 1927-1946	14.3	28.2	33.6	32.4
Tylstrup 1927-1946	23.0	37.8	43.9	40.8

The same result: higher returns by artificial fertilizer than by farmyard manure, has been found in all corresponding experiments at the other stations, as shown in Table 47 which includes the results of the Askov experiments 1894-1903 and 1907-1922.

Farmyard manure has shown a greater residual effect (second to fourth year) than artificial fertilizer in experiments where only a single application of fertilizer has been given. This is due to the fact that a part of the nitrogen in solid manure is not rendered available and utilized until a few years after the application.

Concurrently with these permanent experiments, a series of experiments on the effect of the individual plant nutrients in farmyard manure and artificial fertilizers has been conducted from 1928 to 1938. Only solid manure has been used, and only a single application of farmyard manure and artificial fertilizer has been given. The crops of the first four years were weighed and analyzed for nitrogen, phosphorus and potassium, and the proportion of the various nutrients taken up and removed by the crops during the first four years after the application of fertilizer was calculated on the basis of the analytical data. The main results were as follows:

	Uptake of nutrients in % of quantity applied as	
	Farmyard manure	Artificial fertilizer
Nitrogen	30	70
Phosphorus	24	22
Potassium	79	79

SOUTHERN FERTILIZER & CHEMICAL COMPANY

Main Office: Savannah, Georgia

Superphosphate — Sulphuric Acid — Complete Fertilizers
Ammoniated Superphosphate

Export — Import

Plants: Savannah, Ga., Atlanta, Ga.,
Charleston, S. C., Roebuck, S. C.

Thus of each 100 kgm. nitrogen, only 30 kgm. are removed by the crops of the next four years if the nitrogen is supplied as farmyard manure, against 70 kgm. if supplied as artificial fertilizer. Consequently the farmyard manure nitrogen has shown a value of 30:70, or approximately 40%, as compared with artificial fertilizer nitrogen.

The uptake of phosphorus and potassium, on the other hand, has been almost the same whether these nutrients are supplied as farmyard manure or as artificial fertilizer. Also the long-term experiments discussed in this report show equal uptake of phosphorus and potassium from farmyard manure and from artificial fertilizer. The relative efficiency of the two kinds of fertilizer thus depends essentially on the difference in the availability of their nitrogen.

When an explanation is sought for the comparative inferiority of farmyard manure nitrogen, it must be borne in mind that the calculation of the amount of nitrogen in the applied manure is based on analyses of the manure in the dungheap, and although the manure in the experiments has been ploughed down promptly, it must be assumed that some loss of nitrogen takes place through evaporation of ammonia during the carting and spreading of the manure.

In some instances (winter and summer cereals on Askov loam field) the farmyard manure has been brought out and ploughed down during the autumn. Other experiments have shown that autumn application of farmyard manure may result in a considerable loss of nitrogen through leaching during the autumn and winter. Presumably the fraction of manure nitrogen that is mineralized after the harvesting of the crops will be subject to a similar leaching.

Some of the farmyard manure nitrogen becomes part of the soil humus from which it is only slowly rendered available. This is reflected in the higher nitrogen and carbon content of the manured soil in comparison with the artificially fertilized soil which again is richer in carbon and nitrogen than unfertilized. The following figures show the results of the most recent nitrogen determinations in soil from some of the long-term experiments:

	% nitrogen in air-dry soil:		
	Un-fertilized	Artificial fertilizer	Farm-yard manure
Askov loam-field 1942	0.106	0.118	0.130
Askov sand-field 1942	0.066	0.076	0.086
Lyngby 1933	0.146	0.151	0.169
Lundgaard 1938	0.106	0.110	0.117
Tylstrup 1938	0.118	0.120	0.125

It might perhaps be expected that the higher humus content resulting from the use of farmyard manure would gradually entail relatively better conditions for crop growth. This, however, is not borne out by the long-term experiments.

The ratio between the yields returned by farmyard manure and by artificial fertilizer has remained fairly constant during the years, in respect of individual crops as well as averages for the rotations. On the other hand the relative effect of farmyard manure and artificial fertilizer depends largely on the nature of the experimental crops.

When supplied to mangolds ("Runkelroer"), oats ("Havre") and rye ("Rug"), the farmyard

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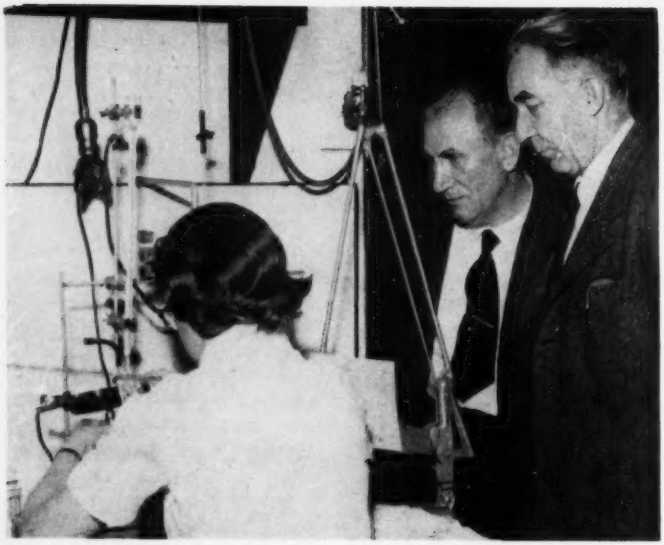

In the soil testing laboratory, the authors and Lucy Elmore, of the N. C. Dept. of Agriculture.

manure is far less effective than artificial fertilizer, but the effect of the two fertilizers is approximately equal in swedes ("Kalroer") and potatoes ("Kartofler"), with the reservation that artificial fertilizer shows its best effect at light and farmyard manure at heavy application. This indicates that farmyard manure should preferentially be used for root crops, particularly swedes and potatoes.

The experiments at Askov loam field and sand field, at Lundgaard and at Tylstrup include plots where nitrogen, phosphorus and potassium for comparative purposes have been applied separately or two and two together. The excess yield returned by the individual fertilizers are smallest at separate application and largest where the three fertilizers are applied in combination. The deficiency of nitrogen makes itself felt already after a few years, while the decrease in yield due to phosphorus and potassium deficiency only reaches its full extent after several years. Crop analyses show that the uptake of nitrogen, supplied in equal amounts, is at all experimental sites considerably smaller from farmyard manure than from artificial fertilizers, but there is no essential difference in the uptake of phosphorus and potassium.

The experiments with single-nutrient fertilizers show that the mobilization of each individual plant nutrient from the soil is strongly dependent on the supply of other nutrients.

A comparison between the amounts of phosphorus and potassium removed by the crops and those found in the soil by chemical determination shows upon the whole a good agreement, the figures for removal being lowest where soil exhaustion has been strongest, and highest where the largest amounts of phosphorus and potassium have accumulated in the soil.

Microbiological investigations by Dr. H. L. Jensen on soil samples from the Askov experiments in 1948 and 1949 show a somewhat greater microbiological activity (higher bacterial numbers and stronger carbon dioxide production) in farmyard-manured than in nonfarmyard-manured soils, but the differences are small and rather insignificant in comparison with the differences in crop yield, and show no correlation with these.

Mr. Iversen, Dr. W. L. Nelson, N. C. Dept. of Agriculture soil testing division director, and Professor Bondorff.

DIFFUSION OF PHOSPHORIC ACID FROM GRANULATED SUPERPHOSPHATE

By A. Demolon[1]

Chemists have been dominated for years by the conception that in an acid soil iron and aluminum ions will react with the soluble phosphate ion to immobilize it and reduce its availability to the growing plant. With this thought in mind the agronomist has built up his recommendations as to the most efficient methods of applying phosphates to farm land.

To determine in more detail what is the mechanism and the rate of diffusion of the soluble phosphoric acid from a granule of superphosphate, Dr. A. Demolon, in France, carried out a few simple tests which are described in what follows. He used silica gel and agar gel as the media through which the diffusion could be traced. The superphosphate granule was placed in the center of the gel contained in Petri dishes. The gel was colored red by means of a neutral rouge for the easier tracing, visually, of the diffusion process in the course of time (Fig. 1). For the tests the author used (1) ordinary water, or a water extract of a soil, (2) a distilled water, and (3) sand as a discontinuous medium.

(1) Bulletin de Documentation, May, 1950.

NOTE: *Farmers and even scientists have speculated about the relation availability to the growing plant of phosphoric acid in granulated superphosphate. Experience has amply demonstrated that granulated superphosphate releases its phosphoric acid more effectively for plant use than powdered superphosphate. Since measurement always gives the best answer, the following report from one of the world's outstanding agronomists, Dr. A. Demolon of France, is most welcome. It gives us a definite insight into the manner in which granulated superphosphate releases its content of soluble phosphoric acid into the soil solution.*

V. Sauchelli

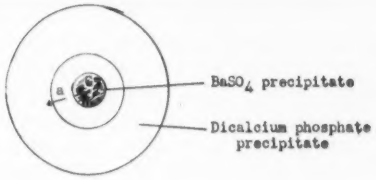

Fig. 1. Diffusion of phosphoric acid from granulated superphosphate in hydrogel.
a = zone of progressively increasing pH.
G = granule of superphosphate.

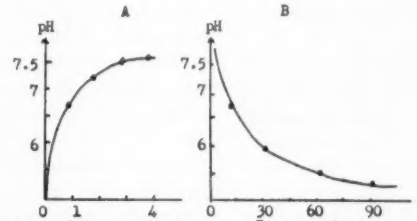

Fig. 2.
A. Variation of pH as a function of the distance from granule after 2½ hours.
B. Variation of pH as a function of the time for a point at 2 mm. distant from the granule.

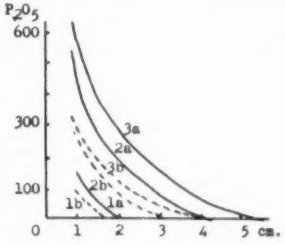

Fig. 3. Diffusion of P_2O_5 after 15 days.

1. Sand with 6% moisture.
2. Sand with 9% moisture.
3. Sand with 12% moisture.

a. Diffusion upward.
b. Diffusion downward.

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A. Test, using distilled water, having an initial pH 6.5

A crystal of monopotassium-phosphate is placed in the center of the gel. The phosphoric acid dissolves and diffuses radially, and as it travels outward it causes a color change due to the acid effect. This change in pH is shown in Fig. 2, which represents the change as (1) a function of distance from the granule, or (2) as a function of time at a given point. The curves are of the exponential type. Change goes on in an orderly, regular manner until homogeneity is reached.

This same relationship is found to hold good when superphosphate or monocalcium phosphate are used. In the case of superphosphate, the amount of phosphoric acid diffused is proportional to the volume of the granule. All of the soluble P_2O_5 diffuses within a few days, as we see from the following data:

P_2O_5 mg.		
Initial amount	Amount remaining after 4 days	Per cent diffused
3.0	0.2	93
15.0	1.05	93

The rate of diffusion increased by about 20 per cent between 0° and 30°C. This was determined by one diameter of the zone of color change.

If the granule is coated with precipitated chalk (calcium carbonate) the rate of diffusion is retarded somewhat; if calcium humate is the coating, no change in the rate occurs.

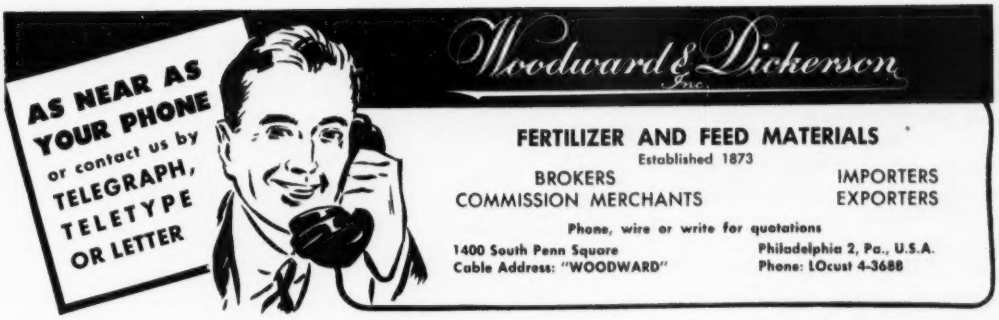
B. Test, using ordinary tap water, or a water extract of soil (pH 7.5)

In this case the monopotassium phosphate diffuses in the manner of the previously described test, even in the presence of calcium carbonate. Superphosphate and monocalcium phosphate diffuse at a slower rate. The minimum pH at the point of contact with the granule increases progressively as distance increases from this point. After 48 hours a perfectly circular zone of whitish color develops at a distance proportional to the diameter of the granule; this zone gradually enlarges due to the precipitation of the P_2O_5 at the surface as dicalcium phosphate (Fig. 1). This precipitation is linked with the reaction: $CaH_4(PO_4)_2 = CaHPO_4 + H_3PO_4$, and occurs only when the pH is greater than 7.0. It was not observed in the previous test using distilled water even in the presence of soluble calcium salts or of precipitated calcium carbonate. In the case of monocalcium phosphate, a second ring is formed in due time completely separate and outside of the first ring. The phenomenon is therefore periodical. In the following table the progress of the diffusion is seen as a function of time and of the size of the granule:

Regarding the calcium sulfate in the superphosphate, if barium chloride, $BaCl_2$, is introduced into the gel, it is evident that its diffusion is at a much slower rate than that of the P_2O_5 of the phosphate. It forms the hollow skeleton of the granule remain-

		P_2O_5				
pH	Weight of granules	At 2 mm. from the granule for time specified			At 35 mm. distance from the granule for time specified	
		1 day	2 days	8 days	2 days	8 days
	19	0.60	0.42	0.31	0.05	0.05
8.1	45.5	1.72	0.69	0.13	0.05	0.05
	106	4.55	1.80	0.44	0.05	0.45
6.1	19		0.28	0.08	0.05	0.05

It is evident that it takes considerable time for the medium to become homogeneous, and that within the acid zone the rate of diffusion suffers a slowdown.



ing unchanged in appearance, after the phosphoric acid has completely diffused from it.

If ferric hydroxide is introduced into the medium of neutral pH, it has no effect on the diffusion; however, dicalcium phosphate no longer precipitates out for quantities of iron above those required for the precipitation of the phosphoric acid. When colloidal clay was introduced into the gel media, no effect was noticed on the diffusion. (See Fig. 1.)

Briefly, then, we see this: in contact with soil solutions and in the absence of any movement of water, there develops around the granule a zone more or less extensive, depending upon the size of the granule, in which a part of the phosphoric acid of the superphosphate remains temporarily in a soluble form, and another portion becoming dicalcic phosphate in the alkaline medium as the distance increases from the granule.

C. Test, using sand as a medium

This test concerns diffusion in a discontinuous medium. To make it, columns of fine sand were used, having 6, 9, and 12 per cent moisture respectively, the last representing the retention capacity under vacuum. The superphosphate (furnishing 15 mg. P_2O_5) was placed either at the bottom or on top of the column and samples were removed after 15 days. The diagram, Fig. 3, shows how the phosphoric acid diffused; the relationship is shown as a function of the distance at the time given.

Conclusions

1. Granulated superphosphate releases its soluble phosphoric acid in the same manner as powdered superphosphate.

2. Diffusion is influenced by moisture: if the moisture content is low, diffusion is slow, and increases rapidly with increasing content of water up to the soil's retention capacity.

3. The rate of diffusion is quicker from below upward than from the top downward.

The speed of diffusion of phosphoric acid in a discontinuous medium depends essentially upon the degree of moisture present, and is but slightly affected by secondary reactions connected with the nature of the medium. Granulation has no effect upon the behavior of superphosphate insofar as diffusion is concerned. Its only effect is in modifying the topographical distribution of the concentrations during a certain time, which is related to the size of the granules. The agronomist and farmer should always keep in mind this effect of placement.

OBITUARIES

William R. Elsas, 45, president of Fulton Bag and Cotton Mills, December 9 of a heart attack suffered while on horseback, participating in a hunt club meeting at Tryon, N. C. **Norman Elsas,** chairman of the board was elected president as well as board chairman at a special meeting of the directors.

William B. Bell, 71, president of American Cyanamid Co., suddenly, December 20 in Marrakech, French Morocco, where he and his wife were on a combined business and pleasure trip. He was also chairman of American Cyanamid, and of Southern Chemical Corp. and Jefferson Chemical Co.

Mrs. F. N. Bridgers, wife of F. N. Bridgers of Farmers Cotton Oil Co., Wilson, North Carolina, December 10.

George Savage Norris, Sr. 60, former superintendent of the Southern Fertilizer and Chemical Co., Jacksonville, Florida, and at the time of his death with Etiwan Fertilizer Company, Charleston, South Carolina, of a heart attack follow outbreak of a fire in the plant, December 22.

I. M. & M. Protects Kin of Service Men

Dependents of International Minerals & Chemical Corporation employees drafted into military service will continue to receive full hospitalization and surgical benefits on the basis of their present coverage under the corporation's group insurance plan. The company will assume all costs, according to Louis Ware, president.

Pension trust policies of drafted employees will be continued during their military leave of absence so that no reduction in retirement benefits will arise due to military service.

The company will pay drafted employees' as well as its own contributions to a group annuity plan for a period of three years, provided employees return to work within 90 days after discharge. This time is subject to extension by the company, Mr. Ware said.

To date 57 employees of International have been called into military service.

German Technical Bibliography Released

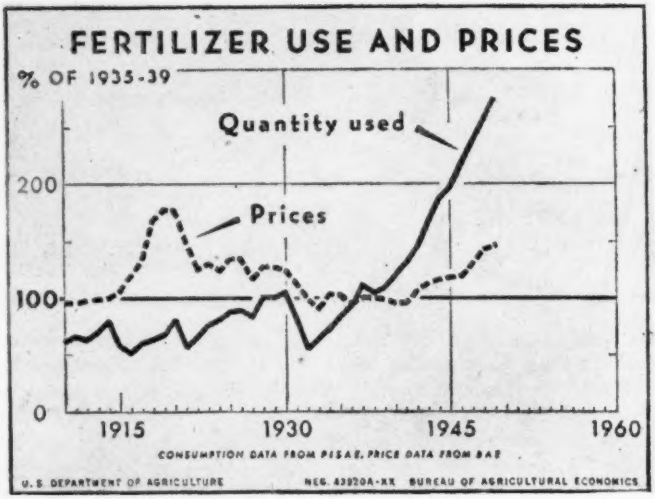
A new bibliography, one of the most complete ever to be issued relating to captured technology from the German chemical, metallurgical and process industries, has just been announced by the Office of Technical Services of the U. S. Department of Commerce.

Product of several years' work by L. Wilson Greene of the Army Chemical Corp, it has been reproduced by O.T.S. because of its usefulness to the researcher in these fields who is seeking full information on German developments.

It contains well over two thousand document references with descriptive titles or abstracts, and includes, in addition to a 6000-entry subject index, author indexes, and cross-indexes with O.T.S., British, and U. S. Military report numbers.

Particularly helpful are the sections dealing with the translations and reports available from private publication services, since O.T.S. has not been able to cover these materials fully in its **Bibliography of Technical Reports.**

In addition to presenting general references on postwar conditions in Germany with regard to the chemical, metallurgical and process industries, the report gives published references for five major classifications of the German chemical industry, including dyes and pharmaceuticals; eleven classi-



From the director's annual report of the Mississippi AES, we extract this BAE-USDA chart, which Director Frank J. Welch uses to point the moral that the great expansion in the use of fertilizers has made a large contribution to the use in farm production . . . but prices of fertilizer have risen less since prewar than have most other prices paid by farmers. Crop-fertilizer price relationships have been such as to encourage larger applications of fertilizer, to obtain additional yields.

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fications relating to metallurgy; and twenty relating to the process industries.

PB 101 458, **The German Chemical Industry, A Bibliography of the Chemical, Metallurgical and Process Industries,** 396 pages, sells for $10 per copy. Orders should be addressed to the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order payable to the Treasurer of the United States.

PERSONALS

(Continued from page 45)

ler reported, U. S. consumption of nitrogen materials as plant food reach an all-time high, and since 1940 the consumption of mixed fertilizers in the Midwest alone has shown a 500% increase.

* * *

Brigadier General Edward Montgomery, USA, RET., has been appointed assistant to the executive vice-president of **Chemical Construction Corporation.** During World War II he was chemical officer, coordinating all chemical warfare work in the Air Force.

* * *

John W. B. Foringer has joined **Lion Oil Company** as director of industrial relations, in charge of all personnel and union labor relations. He is a lawyer with long experience in the personnel and labor relations field.

* * *

Milton G. Peck has been made sales manager for the newly introduced line of **Clark Equipment Company** powered hand trucks, we are informed by W. E. Schirmer, vice-president of the Battle Creek concern.

* * *

Ernest S. Robson, Jr. has been transferred to the **Monsanto Chemical Co's** Western Division office, where he will sell the entire line of chemicals in the division territory. He has been with Monsanto since 1941.

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By J. R. JOHNSON
Extension Agronomist
Georgia Agricultural Extension Service

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When area is seeded in August or September, usually to Ladino-Fescue or annual plants, a top dressing of 100 to 200 pounds of nitrate of soda, or its equivalent, should be applied in November when the plants have become established. Another application of 100 to 200 pounds of nitrate of soda in February or March will increase the production and lengthen the grazing period.

For maintenance of summer permanent pastures, apply 500 pounds of 4-12-12 per acre in spring.

For maintenance of winter permanent pastures (Ladino-Fescue) apply 500 pounds of 4-12-12 in August.

On all permanent areas, keep the grass and clover balanced for maximum production of protein and grazing. Stimulate grass growth by applying nitrogen. Stimulate clover growth by applying phosphate and potash. Meet the lime needs each three years. A soil sample will be helpful in determining these needs.

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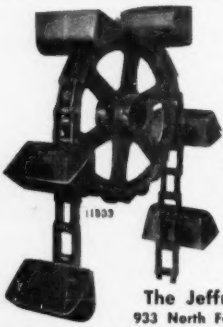

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